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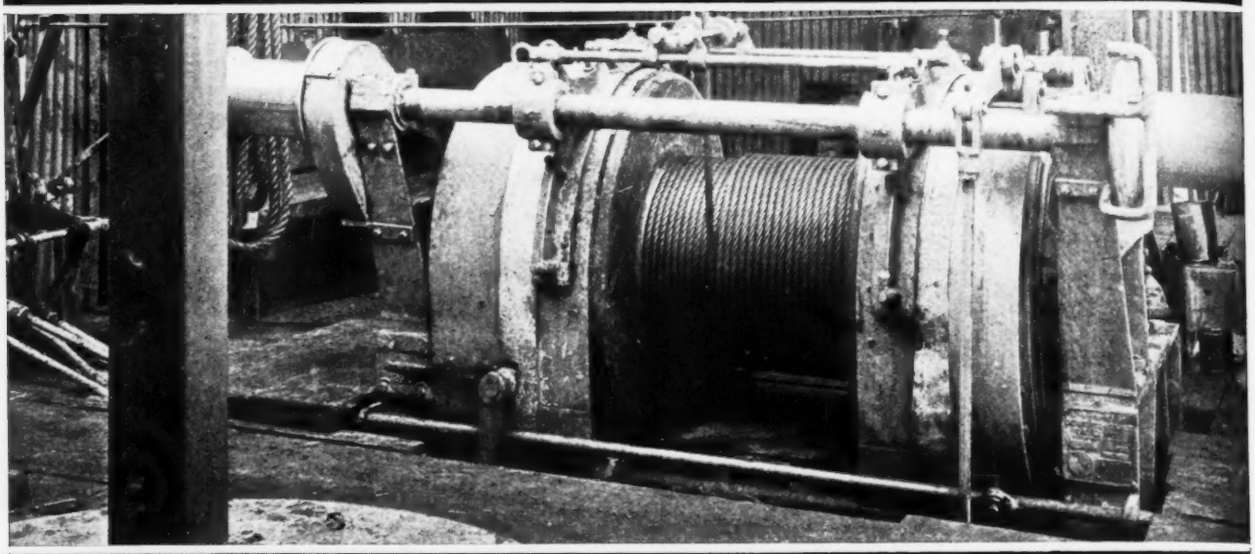

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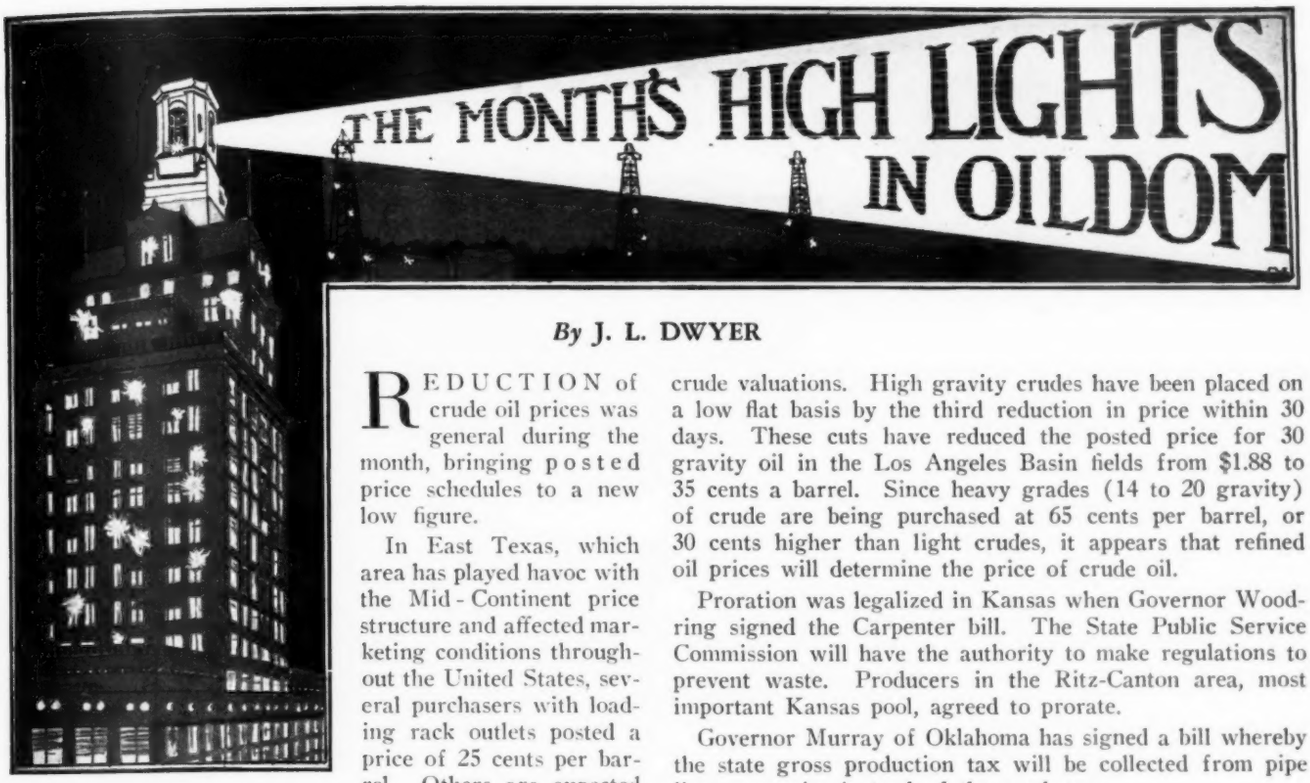


By **J. L. DWYER**

REDUCTION of crude oil prices was general during the month, bringing posted price schedules to a new low figure.

In East Texas, which area has played havoc with the Mid-Continent price structure and affected marketing conditions throughout the United States, several purchasers with loading rack outlets posted a price of 25 cents per barrel. Others are expected to follow their lead. This action, together with the posting by Magnolia Pipe Line Co. of a gravity scale for East Texas crude, on the same basis as schedules listed for other Mid-Continent areas, created a wide differential in prevailing prices.

The Magnolia is purchasing no outside oil, neither is the Humble Pipe Line Company, which completed the second pipe line outlet into East Texas on April 8. Tank car shipments during the week ending April 1 averaged 625 cars daily with a total shipment of over 900,000 barrels for the week.

The only constructive move in East Texas was the passing of an order by the Texas State Railroad Commission calling for the curtailment of production to 70,000 barrels daily with a gradual increase to 100,000 barrels within 90 days. Conditions remain unsettled, however, due to an injunction suit brought against the order by some of the operators.

The gasoline price war in California has completely upset crude valuations. High gravity crudes have been placed on a low flat basis by the third reduction in price within 30 days. These cuts have reduced the posted price for 30 gravity oil in the Los Angeles Basin fields from $1.88 to 35 cents a barrel. Since heavy grades (14 to 20 gravity) of crude are being purchased at 65 cents per barrel, or 30 cents higher than light crudes, it appears that refined oil prices will determine the price of crude oil.

Proration was legalized in Kansas when Governor Woodring signed the Carpenter bill. The State Public Service Commission will have the authority to make regulations to prevent waste. Producers in the Ritz-Canton area, most important Kansas pool, agreed to prorate.

Governor Murray of Oklahoma has signed a bill whereby the state gross production tax will be collected from pipe line companies instead of the producers.

Although drilling in Louisiana has been at a low ebb for some time, it is being discouraged further by a high severance tax.

From a field development standpoint, East Texas is in a class by itself. Daily new extensions are being made to the producing area. During the past month the first producer in Smith county was completed, bringing the third county into the producing area. In addition, several extensions were made to both Gregg and Rusk county pools.

The working out by operators of plans for the development of the Kettleman Hills, California, field under a unit agreement pact assures the industry that an orderly drilling campaign will be carried out in this great producing area.

Eastern producers are astir over the new Tioga gas producing area in Pennsylvania. It is rumored that several companies are contemplating the construction of gas lines to New York City to supply industrial concerns with natural gas for fuel.

Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending March 28, 1931

(Figures in Barrels of 42 Gallons)

DISTRICT	Per Cent Potential Capacity Reporting	Daily Average Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	476,400	77.8	8,690,000	7,244,000
Appalachian	93.8	93,400	70.5	1,766,000	1,107,000
Ind., Ill., Ky.	97.5	297,000	78.0	5,743,000	3,082,000
Okla., Kans., Mo.	89.4	257,900	62.6	3,468,000	3,727,000
Texas	91.9	549,400	73.9	8,088,000	8,096,000
Louisiana - Arkansas	98.3	148,400	56.6	1,994,000	2,254,000
Rocky Mountain	93.1	48,600	34.8	1,893,000	829,000
California	98.8	461,300	52.0	15,802,000	100,929,000
Total Wk. Mar. 28	95.7	2,332,400	65.3	47,444,000	127,268,000
Total Wk. Mar. 21	95.7	2,297,000	64.3	46,758,000	127,691,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts.					
Texas Gulf Coast	100.0	417,300	78.8	6,950,000	5,791,000
La. Gulf Coast	100.0	100,900	68.4	1,805,000	1,213,000

* Revised due to change in California gasoline stocks.

** Revised due to change in California and Louisiana-Arkansas gas and fuel oil stocks. (California, +281,000; Louisiana-Arkansas, +803,000.)

Daily Average Production

(Figures in Barrels)

	March 28 1931	Feb. 28 1931	March 29 1930
Oklahoma	522,800	502,550	615,000
Kansas	109,300	116,150	114,500
Panhandle Texas	55,550	53,950	89,900
North Texas	57,800	58,650	80,450
West Central Texas	25,350	23,950	51,150
West Texas	243,500	244,200	322,000
East Central Texas	169,000	68,350	25,400
Southwest Texas	62,750	78,800	61,000
North Louisiana	39,700	44,900	43,300
Arkansas	46,700	49,850	58,600
Coastal Texas	151,250	157,200	193,650
Coastal Louisiana	26,100	26,450	20,500
Eastern (not including Mich.)	101,700	100,350	120,000
Michigan	8,550	9,350	11,750
Wyoming	40,800	45,550	50,850
Montana	8,900	9,350	9,300
Colorado	4,200	4,300	4,750
New Mexico	41,000	40,950	11,000
California	530,400	530,400	631,100
Total	2,275,350	2,165,250	2,514,200

Wrapping machine traveling on suspended pipe.

Ditching Difficult *and*

By J. H.

Making a double fire-bend.

DITCHING through a maze of jungle swamps and flooded rice fields, the United Gas Corporation is meeting with extreme difficulties in the building of its 423-mile gas line project in south Louisiana. Daily many unusual problems are being encountered.

On most projects equipment can be snaked along with comparative ease, but, on this job, trouble started where the new main line branched from the Magnolia line at Kirbyville, Texas. Leaving a section of treacherous quicksand which had played havoc with equipment and tried the patience of the crews, the line wound its way to the edge of a swamp dense with cypress. Here swamp growth, muck and water proved difficult barriers.

Steam dredge ditching through slough.

Occasionally easier going offered relief for a short distance, only to have a series of stream crossings loom up to tax further the forbearance of the men. On the south end of the system ditching settled down to a matter of penetrating one flooded rice field after another, a condition made worse by rains characteristic of that country in early spring.

To cope with attendant problems, ordinary methods were inadequate. Heavy machinery was kept from bogging down by extensions being made to the crawlers and wide planks used for a track. In many instances it was necessary to build small dikes on the sides of ditch lines, close the ends and pump out the water before the ditch could be cut and the pipe laid. In the swamps the timber land necessarily had to be cleared and, in some cases, dredges used for trenching.

Conditions of this kind naturally make for high machinery maintenance costs. Especially costly are cutting of machinery lubricants by mud and sand, thereby accelerating wear, and bogging of machinery in quicksand and muck, increasing down time.

The entire line is being welded electrically. Pipe diameters range from 14-inch, 41-pound on the main line, to 2-inch, 3.652-pound on some of the laterals.

All diameters down to 6-inch are 30-foot lengths with belled ends. A chill ring is inserted when the pipe is lined up and welds are made ⅛ inch high and ¾ inch wide.

Hazardous *in* Swamps

DAMERON

Clearing out trench behind ditcher.

Laying pipe in a rice field.

Wall thickness and weight of pipe of various diameters follow:

Size	Wall Thickness	Weight in Lbs.
14 O. D.	9/32 in.	41.208
12¾ O. D.	9/32 in.	37.453
10¾ O. D.	1/4 in.	28.035
8⅝ O. D.	1/4 in.	22.361
6⅝ O. D.	3/16 in.	12.891
4½ O. D.	3/16 in.	8.635
3½ O. D.	0.216 in.	7.575
2 I. D.	0.154 in.	3.652

From 6-inch down the pipe is butt-welded with a chill ring. Welds are carefully inspected and, at frequent intervals, the work of each welder is checked by a weld being cut out and tested with portable testing machines. Gates are installed on an average of every six and one-half miles and, when a line test is made, these are blocked off and a 100-pound air pressure built up in the line with portable compressors.

During this test all welds are soaped and the pressure maintained for 24 hours. Main and lateral lines are coated, sometimes with a hot application on a hot or cold primer, again with a cold application only, depending upon conditions. Pipe of diameters down to 6-inch are wrapped.

Virtually all large pipe is being strung with six- and eight-up teams pulling three lengths boomed to wide-tired wagons. Frequently mule teams and bull teams are used to move the generators, which are usually mounted on skids to facilitate movement through mud. Such teams are employed also to move skids on which pipe is placed for coating.

The west end of the project, contract for which was awarded to F. C. Youmans Co. of Houston, presented probably the more difficult construction problems. It traverses a region interspersed with quicksand, dense swamps, timber land and numerous streams.

Emerging from a section replete with quicksand, the crews worked into a swamp and river crossing approach of the types responsible for the time-consuming jobs on the west end of the line. Through low country to the edge of the swamp the ditcher made little progress until 48-inch extensions were bolted to the 30-inch crawler. These were

Looking through swamp after timber was felled.

made with 3-inch by 10-inch by 48-inch hickory boards. Even with such wide crawlers the machine moved forward with difficulty until 3-inch by 10-inch by 16-foot planks were used to support it.

Frequently the ditch caved behind the machine so rapidly that diaphragm pumps, powered by a gasoline engine and usually mounted on skids, were used to remove the muck and water, large chunks of dirt being shoveled out by laborers following after the ditcher.

On the west bank of the Calcasieu River near Lake Charles, La., the line cuts directly through 4,400 feet of swamp country before reaching a clearing of any kind. Before making trench through this swamp the timber had to be felled and stumps blasted. Specifications called for a 24-inch covering on the line at this point, to accomplish which a steam dredge was necessary. The dredge plowed and ripped through the shattered timber and debris, cutting through the clearing a shallow canal approximately 25 feet wide. It being next to impossible to move firing line equipment along this mile section, the entire 4,400 feet of 10-inch pipe had to be floated in, following the usual procedure when penetrating swamps.

The pipe was welded on high ground and moved in sections to the ditch by means of specially built rollers. When a section had been welded and the stream end plugged it was conveyed to the ditch with winch lines on anchored tractors.

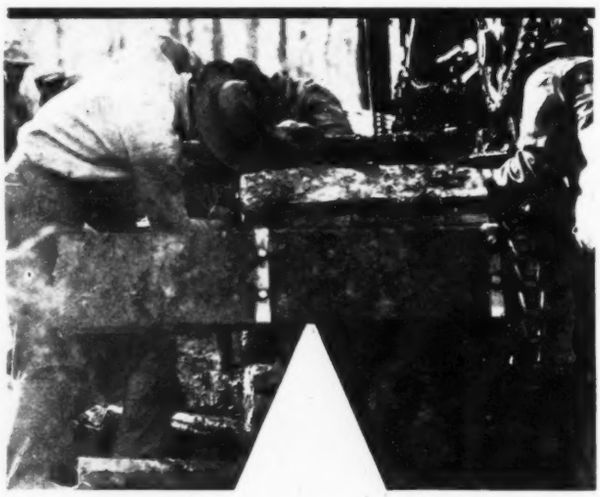
Ten-inch pipe is being used on this section and, thus far, has been floated into the swamps satisfactorily, although the process is slow. Workmen guide the pipe into position by means of handling lines attached to the stream end. On the opposite shore the line was laid in a 2,700-foot trench through a swamp. After the timber had been cut and the stumps blasted, the trench was made by exploding a series of blasting charges spaced evenly down the trench. On an average the shot holes were placed 18 inches apart, four sticks of dynamite in each hole. Larger charges were used for stumps. When 1,400 feet of the ditch had been loaded the first charge was exploded. The percussion of this shot set off each succeeding one in rapid succession, hurling stumps, mud and water high and wide. The pipe was welded in sections, the stream end being plugged and floated into the trench, which was approximately 52 inches deep and 12 feet wide. When the pipe arrived at the point of a bend, cables were lashed to the front end and crews kept sufficient tension on them to swing the pipe around.

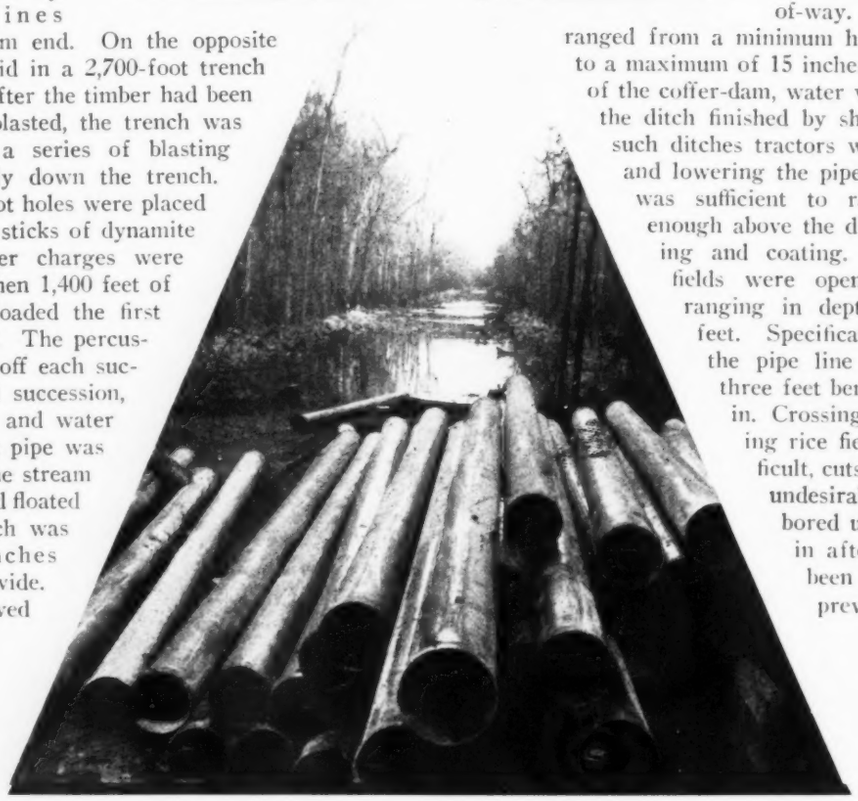
All along this section of the line transportation of equipment was a dangerous as well as difficult task. Frequently a tractor would start over an unsuspected quicksand area and, before it could be maneuvered out, the crawlers and wheels usually became entirely submerged. Teams likewise often suffered the fate of becoming mired and had to be pulled out. Frequently it was necessary for cars to travel a circuitous route of 10 or more miles to attain a point on the line only a mile distant. These conditions combined to retard progress and increase the difficulty of moving equipment. However, despite them, construction work was uninterrupted.

Traversing rice plantations necessitated rapid moving of crews from point to point in order that work in many fields containing 1,000 or more acres might be completed before the fields were flooded with water preparatory to planting. Consequently, when one field had been crossed, the crew might be moved several miles to work in another before time for it to be flooded.

Comparatively little trouble was experienced with tractors in such regions, but the ditchers were impeded by continual caving of the trench. Consequently, two tractors preceded the ditcher a short distance and, with winch lines attached, aided the big machine forward when it encountered rough going.

In most fields gangs of laborers built a coffer-dam by piling dirt from the ditch on either side of the right-of-way. Dikes of this kind ranged from a minimum height of five inches to a maximum of 15 inches. Upon completion of the coffer-dam, water was pumped out and the ditch finished by shovel gangs. Along such ditches tractors were used in raising and lowering the pipe. Usually one skid was sufficient to raise the line high enough above the ditch to permit welding and coating. In a great many fields were open drainage ditches ranging in depth from two to 15 feet. Specifications required that the pipe line trench be at least three feet beneath these and cased in. Crossing the levees surrounding rice fields was equally difficult, cuts through them being undesirable. Each levee was bored under and casing put in after the approach had been cut and timbered to prevent caving. As the





Top — Bolting extensions to ditcher crawler.

Left—Looking through 4400-foot swamp cut.

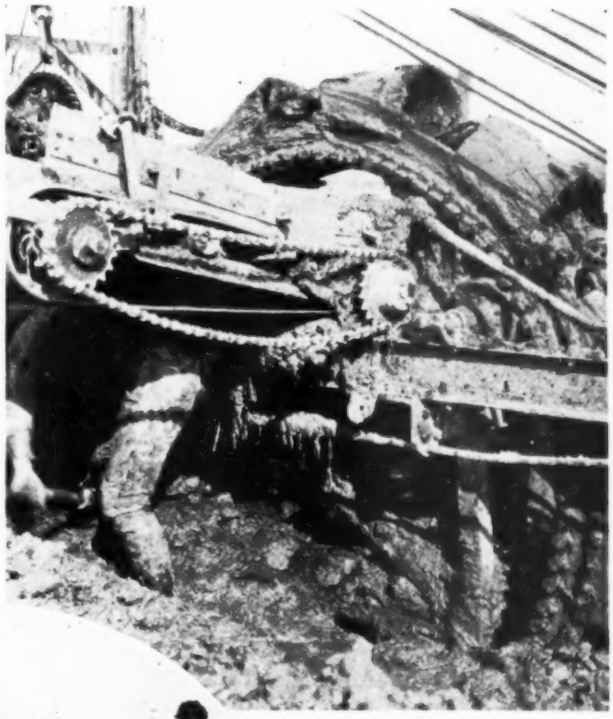
accompanying photographs indicate, ditchers worked under extreme difficulties in the muck. At regular intervals the machine became burdened with the increased weight of gathered mud which frequently had to be cleaned off. Also, the machine's weight often would cause the ditch to cave and it was necessary to pull the machine with tractors, with the mud pump previously mentioned working directly behind it to remove water. Shovel gangs brought up the rear to clean the trench.

Because of the amount of blasting necessary in removal of stumps and preparation of the right-of-way, river clamps are being used to weight the pipe down and hold it in place. In some cases stakes have been driven down on each side of the pipe to prevent snaking in the ditch while lowering.

In general the backfill has been made with machines in the usual well-mounded form. No effort has been made to backfill through the swamps, the pipe being permitted to find its bed by its own weight in the soft mud of the bottom of the ditch.

River crossings are of the multiple line type of construction. The fact that rivers are higher in spring has increased slightly the work of grading banks and placing of lines. Low land on either side of the rivers, however, has been responsible for serious difficulties in moving material and handling of equipment.

While transportation of materials and equipment was a problem on the eastern end of the line, contract for which was awarded Sexton Corp., Houston, that end was not fraught with the hazards of transportation experienced on the western division. It was possible to string more pipe along the right-of-way on the eastern section, either by teams or tractors, and timber barriers were fewer. Condition of the right-of-way through the rice fields after pipe-laying was completed made an excessive amount of hand work and the use of Marmon boards necessary.



Above—Close-up of ditcher bogged in rice field. Note workman underneath cleaning mud from cutting wheel.

Right — Building coffer-dam across rice field.
Below — Shoring on side of canal.

Throughout the length of the main line system use has been made of the wrinkle expansion joint to assist in making bends and to relieve stresses that might result from the pipe sinking in soft earth after being buried. This condition, however, is not expected to cause trouble.

The entire job, so far, has been a dependable test of all forms of pipe line ditching equipment. Conditions are continually being encountered which require the use of clamshells and dredges that in dry summer weather a regular ditching machine could easily take care of. In some places no kind of machine ditching is practical and it is necessary to resort to hand ditching. In the worst places skids are being used for cribbing to support the side walls of the ditch until the pipe is in place and in readiness for backfill.

Completion of the line has been delayed due to rainfall retarding work and because crews had to be pulled from one section to another to cross rice fields before planting time. It is expected that the line will be completed early in the summer.

Phillips' Production Methods Results *in* Oklahoma

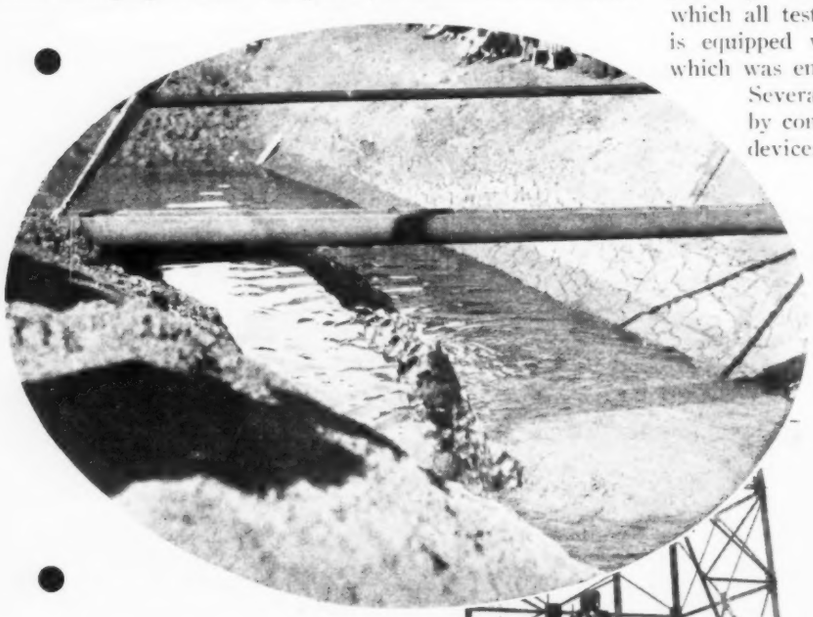
ONE million barrels potential daily production within seven months after the completion of its first well is the remarkable record made by the Phillips Petroleum Company at Oklahoma City. This feat becomes truly phenomenal in consideration of the fact that it was accomplished in an area where the producing horizon is a mile and a quarter below the surface, requiring an average drilling time of 68 days for each well.

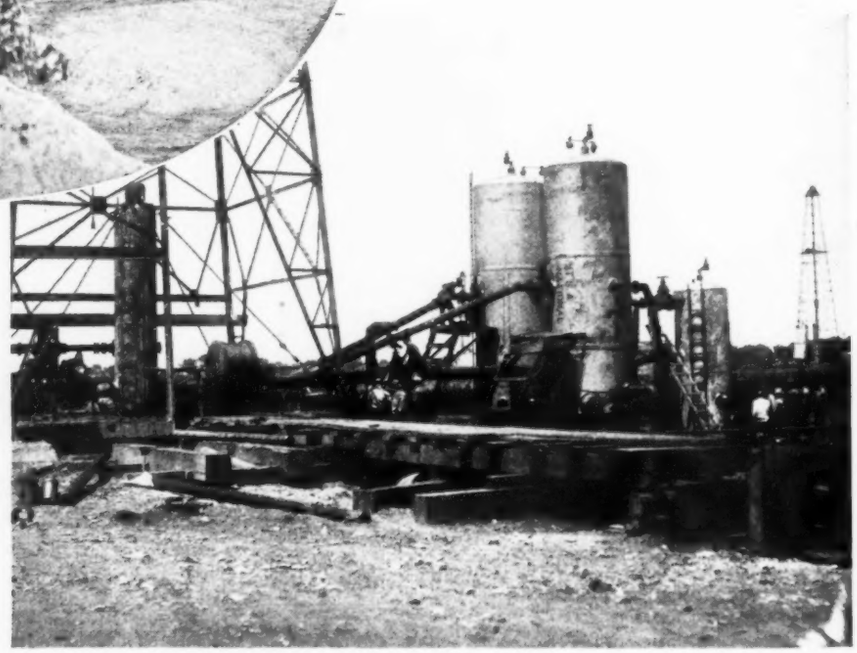
This million barrels potential daily production has been reached with 28 completions, of which, all but six are in the Wilcox sand area. These six wells average only 5,600 barrels each, or 33,600 barrels total. Therefore, it may be said that 22 wells (Wilcox sand producers) are responsible for virtually all of the large potential. Several Phillips-completed wells are listed among the largest producers in the field, which contains some of the most productive light-gravity oil wells in the United States. Many of Phillips' larger wells are closely surrounded by comparatively small ones belonging to other companies, evidence that the actual production of a well is often, in large measure, governed by the manner in which it is completed and by the way it is subsequently handled.

It is interesting to note that until May, 1930, the Phillips acreage in the Oklahoma City field was comprised of but few holdings in the south end and scattered bits elsewhere, none of which was in the Wilcox sand producing area. About that time the Wilcox area, a crescent-shaped region encircling the Arbuckle lime on the north and northwest was attracting attention, and the Phillips Company decided to play the area heavily, although it was not well defined. The ultimate success of the Phillips drilling campaign established the wisdom of this decision.

A review of the company's activities in Oklahoma City in reality amounts to a study, from an engineering standpoint, of advanced methods of completing, producing and controlling high-pressure, sand-producing, large-initial-flowing oil wells. To the engineering and production departments should go much credit for the efficient and safe manner in which all tests have been carried out. Each Phillips well is equipped with strictly up-to-date equipment, much of which was entirely new to the oil industry when installed. Several noteworthy improvements have been made by company engineers on hook-ups and flow control devices for preventing sand cutting of equipment.

Phillips men attribute much of their success in securing such producers to their practice of drilling the oil producing horizon with clear water. This not only renders completion easier, they have found, but prevents mud from settling to the bottom of the hole and compacting when the well is down. Compacted mud not only injures the produc-





Above—Phillips well flowing rotary mud into slush pit as it is completed.

Right—A Hughley-Slick well hook-up.

Give Exceptionally Good City Area

By WARREN L. BAKER

ing sand but damages flow equipment when the well is being completed. Thus far no trouble has been experienced with wells getting out of control. A Phillips well in this area has never gone wild. This is fortunate indeed, since all of the company's Wilcox sand district acreage is in small townsite tracts, much of it within the city limits.

The company's first completion in the north end of the field was Traders Compress No. 1, completed July 14, 1930. This, however, was not a Wilcox sand producer. The well, although one of high pressure, was brought in without sand cutting trouble.

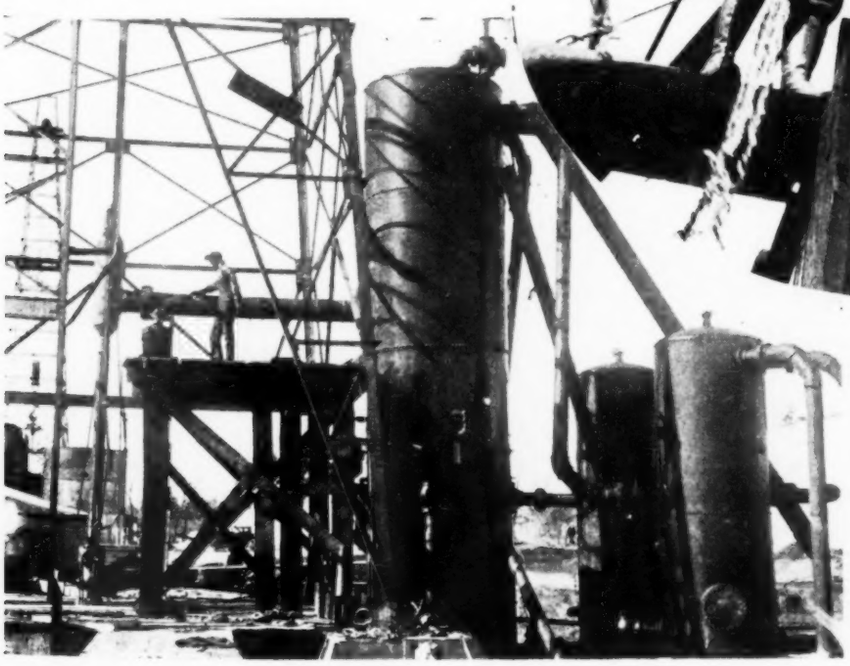
No troubles of the kind were anticipated when the first Wilcox sand well, Day No. 1, was drilled in, but it turned out to be the first of many completions difficult because of sand. The Day well cut out some of its connections when it came in making 600 to 700 barrels of sand per hour. Other early Wilcox sand wells gave similar trouble, causing Phillips engineers to institute research for additional methods of combating sand cutting.

The fruits of their study were first put to practical usage in executing the Hughley-Slick hook-up. This hook-up consists of a sand hog set over the casinghead to function as an expansion chamber as well as to receive the force of the sand when necessary to turn the flow for the separators from vertical to horizontal. Next a mud-hog was added to the Hughley-Slick set-up. The mud-hog, a trap designed to take the rotary mud and sand from the flow, is set behind the two oil and gas separators and with it wells are completed without open flow. Full details of the Hughley-Slick set-up were set forth in The Petroleum Engineer for June, 1930, and July, 1930.

Originally all operators in the field were completing wells with an expansion chamber of some sort over the casinghead, the purpose of which was, by allowing an expansion of the oil flow, to cut down its velocity and reduce sand cutting. Phillips operating men experimented with the idea and originated a type of expansion chamber, smaller than standard and made of 15½-inch casing four to eight feet in length. The top of the chamber was leaded so as better to withstand the force of impinging sand.

A long cast-iron choke was first tried on Ciger No. 1 well, which had cut out its connections. Before the choke was installed the well made 2,240 barrels of oil and 60,000,000 cubic feet of gas in 55 minutes, with 600 barrels of sand. A 2¾-inch choke was placed on the well while flowing and, after four hours, it had reduced its gas output to 30,000,000 feet, half of what it had been. At the same time, the well made an average of 2,170 barrels of oil, flowing with 700 pounds back pressure. After the first hour the well was free from sand.

This was, perhaps, the most important single advancement in handling Oklahoma City producing wells, the sharp reduction in gas-oil ratio being of untold worth, while flow



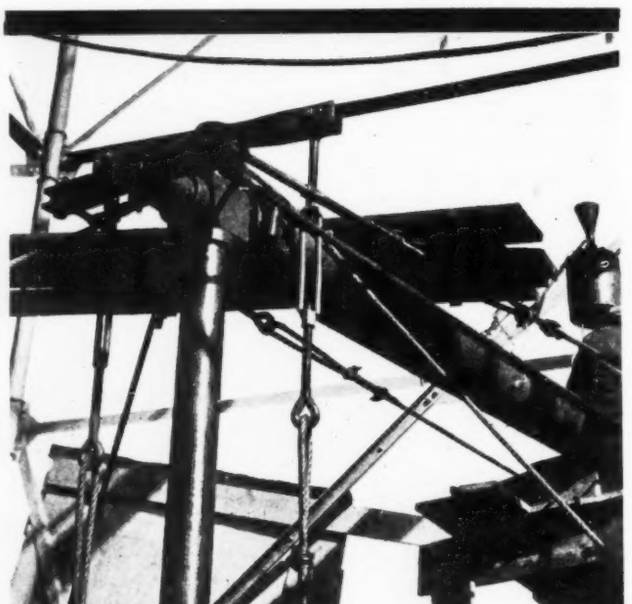
Above—Treating oil flow at well during completion.

Left—Expansion chamber and separator hook-up on Phillips Roden No. 1.

is so satisfactory that the Phillips Company started using chokes of various sizes on all completions, depending upon the characteristics of the well. The average sized choke is a 4-inch one. During a potential flow the Ciger well made 9,497 barrels of oil in four hours with a gas flow of 45,000,000 feet daily through a 3½-inch choke.

Such outstanding success with the choke caused the company to decide to place one on the Day No. 1, after it had cut its connections. The master gate being damaged, it was decided to kill the well, and this was accomplished by means of water. A measurement of the sand in the bottom of the hole showed 500 feet. When the well was opened up with the 4-inch choke the flow was first water, then sand, followed by oil. It was found that the killing of the well with water was not injurious; evidently the sand keeping the oil and water separated.

Subsequent Phillips completions were brought in through chokes, then being made of forged steel, and with the aid of a special type of separator for handling sand and mud along with the oil and gas. This set-up kept oil off the ground, important during the completion period. The first two wells to be completed by this method were Roden No. 1 and King No. 1. The flow of these was directed to the flow-head, thence through a 12½-inch horizontal line to the separators, of which there were three. Mud and sand were taken out of the bottom of the largest separator, and the mud conveyed to the slush pit; while the sand, after the well had cleaned itself of all mud, periodically was taken to a sand-settling tank for the purpose of removing such oil as might be mixed with it. The smaller separators were utilized primarily for additional scrubbing of the gas. A full description of this separator hook-up appeared in The Petroleum Engineer for December, 1930.



Tee flow connection used by Phillips.

The Roden well had an output of approximately 66,000 barrels per day with 57,000,000 cubic feet of gas. A pressure of 45 pounds was on the separator and the well made 500 barrels of sand per hour. King No. 1, incidentally the first Phillips completion within the city limits, made 5,410 barrels in two hours and 30 minutes. The well was completed with the gas going directly into the gas line instead of into the air through vents, the first time this has been done at Oklahoma City. The well came in so easily and quietly through the new hook-up that the spectators did not know when it had been completed.

Later the company started completing all city wells with the large "grief" separator, one or two auxiliary separators and forged steel chokes. The new hook-up permits the use of the same separator both for flowing and completing the wells. Such an arrangement enabled the company to simplify the well hook-up, there being no gate valve on the flow line beyond the master gate to the vent line. The separator has a special safety valve.

Another innovation adopted by Phillips was the replacing of the expansion chamber with steel trees capable of withstanding eight or ten-thousand pound pressures. These permit no expansion, but withstand sand cutting very successfully, although the direction of the flow is changed from vertical to horizontal by means of a "cross" with a hollow bull plug in one end. Between the cross on the well and separator, the connecting flow line, which is of 12½-inch pipe, is used as an expansion chamber. These steel crosses, 7-inch O. D. casing size, are screwed on top of the well casing. One side outlet is connected to the 12½-inch line to the separator, a coupling being attached to the line just outside the steel cross. This piece of equipment was fully described in The Petroleum Engineer for March, 1931.

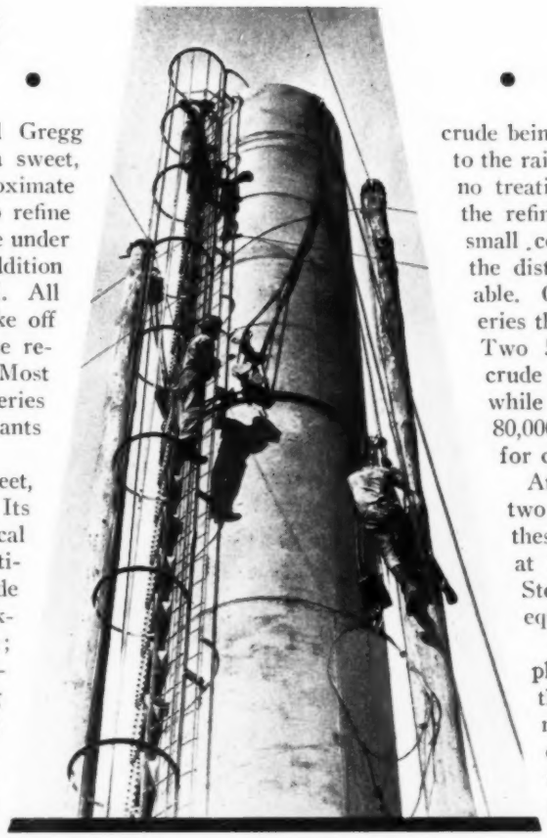
After taking a potential gauge on a well a stuffing box assembly consisting of an adjustable type needle-valve choke, with removable seat to accommodate any size choke desired from ¼-inch to 4-inch, is inserted in the other horizontal opening of the cross. These chokes work so successfully that by their use a well's production has been reduced from 2,500 barrels to 35 barrels per hour. All cutting action is confined mainly to the seat or short choke nipple, which is replaceable.

The Phillips Company has derived much benefit from its method of choking wells. A definite check is made on each well to determine the lowest gas-oil ratio, and, when wells are flowed at this ratio, the oil produced is of higher A. P. I. gravity. The most desirable gas-oil ratio has been obtained with chokes ranging in size from ¼ to 1¼-inch. A ¾-inch choke usually allows a flow of 400 barrels and a 1¼-inch choke 800 barrels an hour flow. An additional advantage of choking wells is that the supply of gas to casinghead gasoline plants has been more steady and uniform. The first graduated choke installed by the company was on the Day and Roden wells, each of which flowed over 50,000 barrels without injuring the choke appreciably.

A very interesting observation of the Phillips Company is the effect that casing size has on a well. On its Nunn well, cased with 9⅝-inch casing instead of the usual 7-inch, and produced through a 4-inch choke, 30 per cent more oil than that of nearby wells was obtained. In four hours this well made 11,001 barrels and 50,000,000 feet of gas. It is completed with 9⅝-inch casing set at 6,300 feet. This is the longest string of 9⅝-inch casing in the field and weighs more than 126 tons. Two other wells have since been finished with 9-inch casing.

All production from new wells is treated for cutting as many of the wells "drink" water when being drilled in. The treating chemical is introduced between the cross on the flow line and the separators. Treating is continued until it is certain that all of the water in the well has been expelled.

Refining East Texas Crude



Right — Looking up fractionating tower of East Texas Refining Co., Henderson, Texas.

By F. R. STALEY

OIL produced in Rusk and Gregg Counties of East Texas is a sweet, mixed-base crude of an approximate gravity of 40 degrees A. P. I. To refine this a number of small refineries are under construction in the territory in addition to the three completed early in April. All are skimming plants designed to take off gasoline and kerosene distillates, the reduced crude being sold for fuel. Most of the production is shipped to refineries located on the Gulf Coast or to plants outside the state.

The straight run gasoline is sweet, and requires little or no treatment. Its anti-knock properties are identical with those of the average Mid-Continent sweet crude. East Texas crude can be refined by distilling and cracking the gas oil or the reduced crude; or it can be processed in the conventional manner of manufacturing lubricating oils: a wax distillate cut being made, and a cylinder stock, which can be treated for bright stock by the same methods employed for Oklahoma City crude.[1]

Although, for the present, none of the new refineries in this field will include cracking units or lube plants, these will no doubt be added when economic conditions warrant, since the high quality of the crude would not justify its continued use for fuel because of its lubricating base.

The East Texas Refining Co., a subsidiary of the Burford Oil Co., has built two refineries in East Texas, one located just east of Longview and the other near Henderson. J. J. Thomas, vice-president of the company, designed both plants, directed their construction and has charge of their operation. The plants were designed and built so that future expansion will be possible.

Each refinery has a capacity of 5,000 barrels per day. The distillation unit in each consists of a pipe still and a bubble type fractionating tower, seven feet in diameter and 68 feet high. Condensers are of the submerged coil type. Stills and boilers are fired with fuel oil produced in the plant. Gasoline and kerosene distillate cuts are taken from the tower, the reduced crude being sold for fuel, for the most part to the railroads. Since the gasoline is sweet, no treating is required, although some of the refineries in East Texas will embody small continuous treating plants to give the distillate a caustic wash when desirable. Crude oil is delivered to the refineries through four-inch welded pipe lines. Two 5,000-barrel tanks are used for crude storage at the Longview refinery, while at Henderson the plant has one 80,000-barrel and two 5,000-barrel tanks for crude storage.

At each plant steam is generated by two water-tube boilers; at Longview these are 310-horsepower, while those at Henderson are somewhat smaller. Steam pumps form a part of the equipment at both places.

In almost all other respects the plants are identical. Wells serve as the source of water supply for both; modern cooling towers with concrete basins cool the condenser water for recirculation. Both plants are located on a railroad and, although loading racks have been built, only a part of the finished product will be shipped in tank cars, the remainder to be transported to service stations by truck. At both Henderson and Longview a building to house an office and small testing laboratory has been put up. Other buildings are pump houses and receiving houses.

The Beacon Oil and Refining Co. has constructed a 2,000-barrel refinery at Overton under the supervision of T. P. Cannon. This also is a skimming plant, the installation consisting essentially of a battery of six shell stills and two steam boilers.

The stills will be operated in a battery continuously, taking off gasoline, kerosene, and gas oil whenever the crude is run to cylinder stock. Each of the two lead stills is equipped with a fractionating tower.

The plant is situated so that the crude can gravitate to it from storage tanks located on a hillside. At Overton also a small continuous treating plant has been constructed to give the distillate a

Boilers and still being installed at East Texas Refining Co. plant, Henderson, Tex.

[1] Processing Oklahoma City Crude, The Petroleum Engineer, April, 1930.

caustic wash whenever necessary. In addition to the plants described, several others are proposed for East Texas. The Taylor Refining Co. will build a plant at Tyler, while the Slack Petroleum Co. has announced plans to construct a 2,500-barrel plant at Willow Springs, near Longview, to process Gregg County crude.

Gasoline Plants

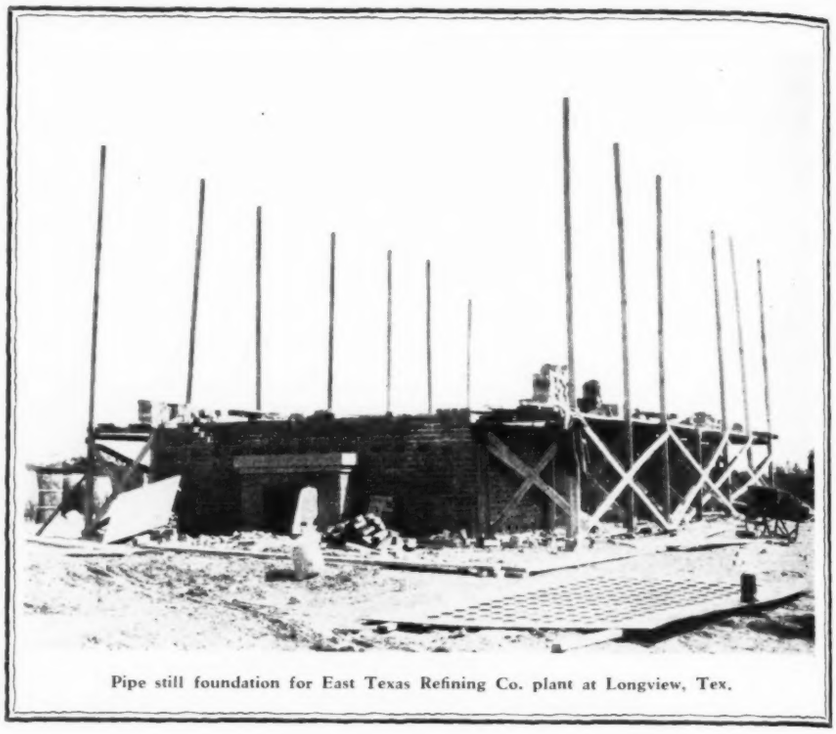
Due to the field's somewhat limited quantity of gas, and to the present irregularity of production, no gasoline plants have yet been erected, although consideration has been given to this phase of the development by several companies, including the East Texas Refining Co.

Tests of Crude

A laboratory examination of a sample of Rusk County crude follows:

TABLE I

Gravity	39.8 A. P. I.
I. B. P.	122° F.
20% at	284
50% at	550
Color	Dark Green
Cold Test	Below Zero
Asphalt	0.48%
Sulphur	0.27%



Pipe still foundation for East Texas Refining Co. plant at Longview, Tex.

BASE

Gravity	25.1 A. P. I.
Flash	390° F.
Vis. at 210	81
Pour	90
Sulphur	0.48%

APPROXIMATE YIELDS

Gasoline	36%
Kerosene	9%
Gas Oil	18%
Base	35%

Another laboratory reports the analysis of a sample of Gregg County crude as shown in Tables II and II-A

TABLE II

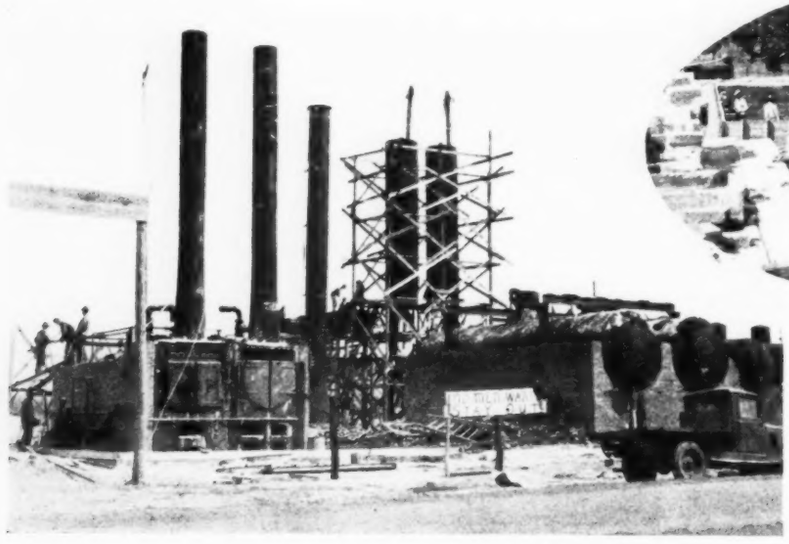
Product	% Yield	Gravity	Flash	Fire	Color	Vis.	Cold Test
Naphtha	40	56.6 (428 E. P.)	.....	.....	30	.....	.....
Distillate	5	38.3	180	210	No. 1	.....	Zero
Gas Oil	15	35	250	270	No. 1	.....	10 F.
Lube Dist.	27.5	28	365	420	No. 8	44@210	Solid at Room Temp.
Residuum	10.5	Spec. Grv. .997@77	615	710	Dark Green		Melting Point 170°

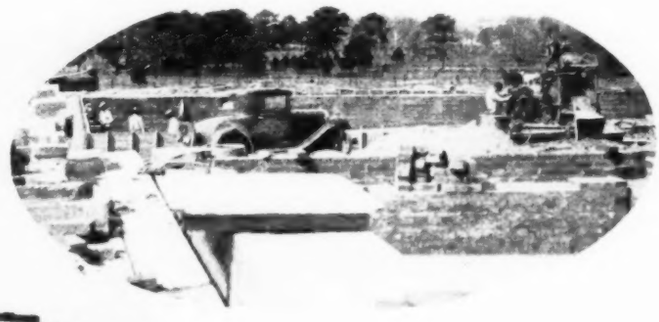
Tests on 5% Cuts From 60%

TABLE II-A

% On Crude	Viscosity @ 100	Flash	Fire	Color	Remarks
60—65	54 sec.	320	380	1½	.....
65—70	75	375	425	2	Remains solid at room temp.
70—75	129@100	410	480	5	Remains solid at room temp.
*75—80	50@210	430	525	8	Remains solid at room temp.
*80—87½	65@210	435	545	8	Remains solid at room temp.

*Too waxy for viscosity at 100°.





Above—Foundation for cooling tower, East Texas Refining Co., Longview, Tex.

Left—Boilers and stills for Beacon Oil & Refining Co., Overton, Tex.

Existing *and* Contemplated TRANSPORTATION LINES *in* East Texas

UNLIKE the situation in the West Texas area where, during the first months of activity, transportation facilities were inadequate (later, however, through an impressive pipe line building program this condition was remedied) East Texas thus early has ample transportation facilities to move sufficient production to fulfill requirements of the sliding scale which the Texas Railroad Commission ordered for the area. Under this order East Texas was permitted to produce 90,000 barrels daily beginning April 10, to be increased gradually to 130,000 barrels daily by July 1, when the order expires. At present, East Texas is moving in excess of 100,000 barrels daily, the bulk of which is going by rail to points on the Gulf Coast.

One of the busiest switching points in East Texas is at Friar's switch (shown above), located north of the Joiner pool.

East Texas has the advantage of being in close proximity to several major trunk systems which terminate on the Gulf Coast. West Texas, on the other hand, was isolated from line facilities. The entire East Texas area is literally threaded with short loading rack lines, loading rack capacity now being approximately 900 cars or 180,000 barrels.

This capacity is almost double present requirements. Trunk line capacity will, no doubt, be greater than the above figures.

Magnolia Pipe Line Co. has completed a 10-inch extension to its Louisiana-Arkansas-Port Arthur line from a point near Center, Texas, to the initial station in south Gregg county. The Magnolia Co. proposes to purchase in the three East Texas districts.

Two lines are being built to Shreveport refineries. Ford Bacon and Davis, Inc., are building a 70-mile, 8-inch line for the Arkansas Fuel Co. from the Lathrop area and the Atlas Pipe Line Co., Shreveport, a 68-mile, 8-inch line from Willow Springs to Shreveport. The latter line connects with a rack line from the Lathrop pool. Later, this company plans to purchase in other districts.

Texas legislative action, which limited pipe line companies to a 10 per cent net earning, delayed the entrance of some major transporters in this area and is still holding a few projects in abeyance.

Humble Pipe Line Co. started an 8-inch welded extension from its Van pool to Shreveport (10-inch trunk), but this work was shut down pending the final outcome of the bill.

Texas Pipe Line Co. awarded contract to N. A. Seigh, San Antonio contractor, to build 50 miles of 10-inch welded line from part of its main trunk line running near Nacogdoches.

By reaching this line the company is in a position to pump to its line running to Houston or to that going to Port Arthur. In event of the former routing the company plans construction of three booster stations. Sinclair Texas Pipe Line Co. is reported considering a trunk system from East Texas and to have purchased 35,000 tons of pipe. Another rumor has it that the company will build 180 miles of 12-inch to the Houston ship channel, while still another adds a 12-inch line to the company's Oklahoma system.

Fredell Construction Co., Denver, Colo., has completed preliminary work for the Gulf Coast Pipe Line Co. (a Yount-Lee and Moody-Seagraves interest), which provides for the building of a 186-mile, 10-inch or 12-inch line to Beaumont, Texas.

Gulf Pipe Line Co. has an 8-inch lateral to the Bateman area which passes close to the Joiner pool.

Three other lines are contemplated for this area: Shell Petroleum Corp. is reported considering building a line from

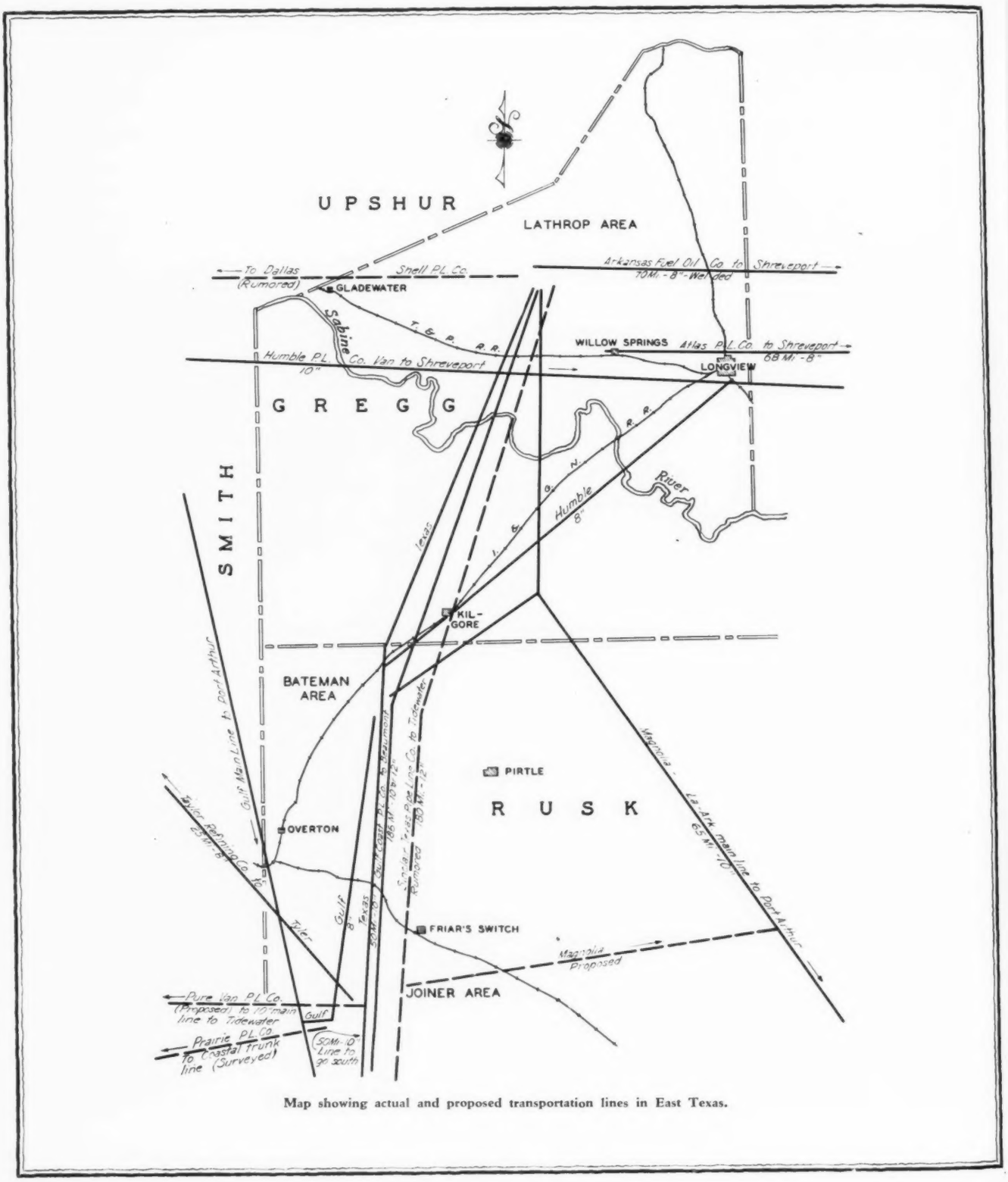
the Lathrop area to Dallas, where the company is thinking of constructing a refinery.

Prairie Pipe Line Co. may enter the field through its subsidiary, the Pure Pipe Line Co. of Texas. Route for this line has been surveyed to run west toward Corsicana, where it would tie in to the system continuing on to the Gulf Coast.

When the survey was made it was announced that no definite plans for construction had been laid, the survey being intended to facilitate construction in the event plans to enter East Texas materialized.

The Pure-Van Pipe Line Co. (Pure Oil Co. subsidiary), is said to be considering a line extending west from its 10-inch trunk between the Van pool and Smith's Bluff, Texas. Taylor Refining Co. is reported to be considering the construction of an automatic station for its 25-mile line from the Joiner pool to its refinery under construction at Tyler.

From a construction standpoint, East Texas offers no formidable barriers other than having to contend with mud during spring rains.



Map showing actual and proposed transportation lines in East Texas.

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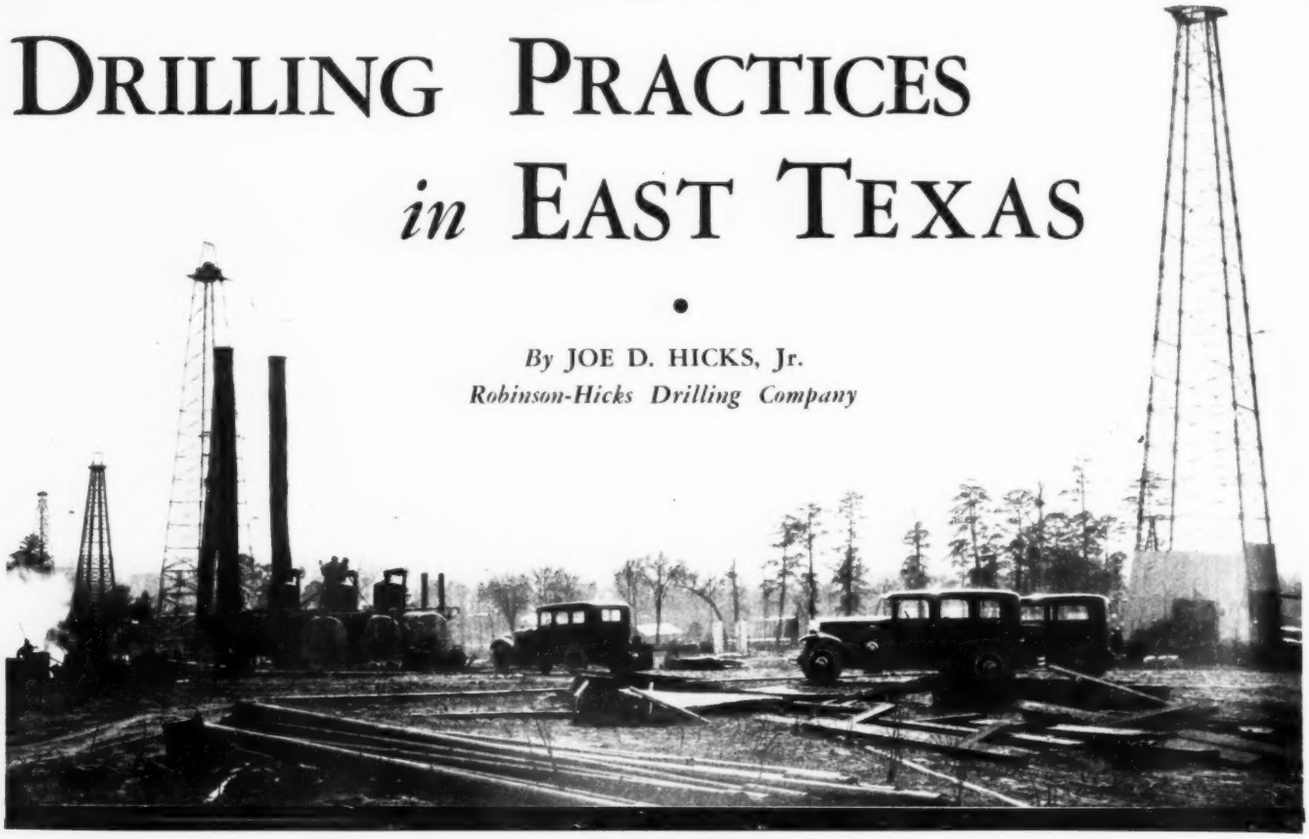
DRILLING PRACTICES *in* EAST TEXAS

By JOE D. HICKS, Jr.
Robinson-Hicks Drilling Company



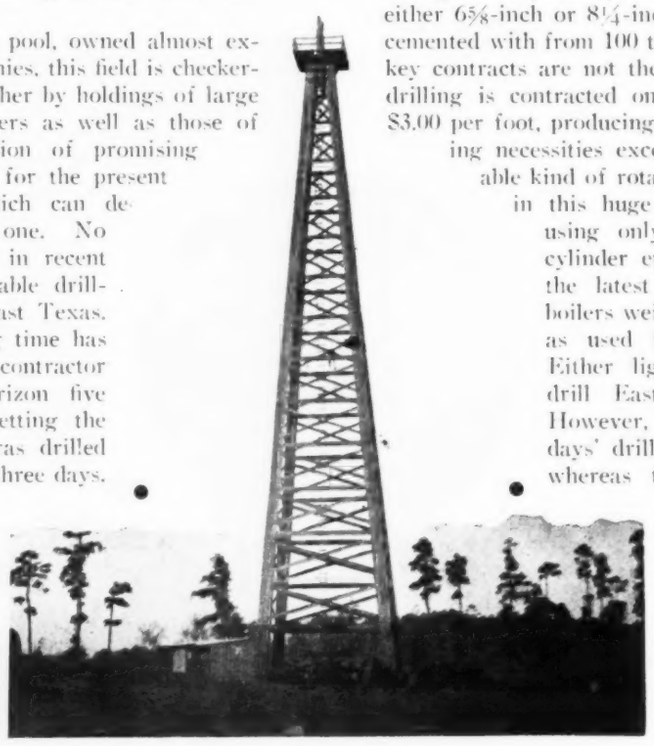
East Texas field scene.

THE East Texas boom has come to be a real business-like oil field development. The field, as now seems apparent, will either be comprised of three large pools, or, as many think probable, the three will merge to make one of enormous proportions. On the extreme south of what is known as the East Texas area is the Joiner pool; six miles north of that is the Bateman-Crim pool, and ten miles north of the Bateman-Crim is the Lathrop pool. These pools have already become sizable and contain scores of wells, some of which are making thousands of barrels daily.

Unlike the neighboring Van pool, owned almost exclusively by a few large companies, this field is checkerboarded from one end to the other by holdings of large and small independent producers as well as those of major operators. Such division of promising acreage is largely responsible for the present active drilling campaign, which can develop into a most extensive one. No competitive drilling campaign in recent years has offered such favorable drilling conditions as found in East Texas. So far, unusually fast drilling time has been made. One drilling contractor penetrated the producing horizon five days and four hours after setting the surface pipe. Another test was drilled to a depth below 2,800 feet in three days. During the earlier history of the field it was thought that the average completion would take approximately 30 days, but it now appears that this figure was high, 20 days being more nearly accurate.

The cost of development in East Texas is comparatively small, due to softness of formations encountered and the shallow depths, which average 3,600 feet. At this time there seems to be no set price paid contractors as in most fields in the Mid-Continent. The lowest contract price for a turnkey job reported thus far is $11,000, the term "turnkey" to be interpreted as meaning that the contractor furnishes the derrick, fuel, water, slush pits and everything incident to the drilling of the well, except the casing, which is supplied by the producer. Only a few joints of surface casing are required (75 to 250 feet) and one string of either 6⅝-inch or 8¼-inch set on top of the sand and cemented with from 100 to 300 sacks of cement. Turnkey contracts are not the rule, however. Most of the drilling is contracted on a footage basis at $2.50 to $3.00 per foot, producing companies furnishing all drilling necessities except the tools. Every conceivable kind of rotary drilling equipment is found in this huge field, from the lightest type using only one small boiler, a single cylinder engine, and one mud pump, to the latest heavy type, requiring three boilers weighing 4,000 pounds each, such as used in the Oklahoma City field. Either light or heavy equipment will drill East Texas wells satisfactorily. However, with the light outfit, about 50 days' drilling time per well is required, whereas the large rigs, with greater power, have, in a few instances, completed a hole from top to bottom in less than a week.

Derricks are usually 122 feet in height, with a 24-foot



Lathrop area discovery well, owned by Arkansas Fuel Oil Co.

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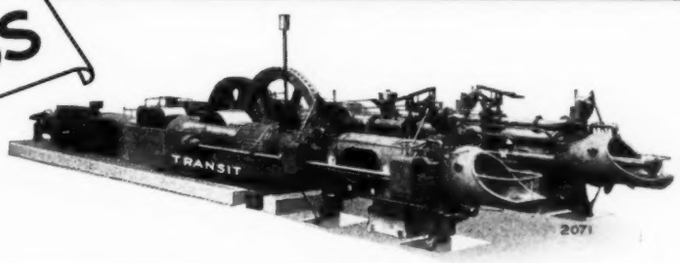

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base. Although, at first, all derricks were of wood construction (the pools being located in the pine lumber country) many now being erected are of steel construction.

Very little time is consumed in rigging up as equipment is light and very little foundation work is necessary. No cellars are dug, and a large number of the rigs have no roofing.

Gas, the fuel used for firing boilers, is secured from gas lines of a commercial company. The average gas requirement per well is 60,000 cubic feet daily and a representative monthly gas bill will amount to $1,200 to $1,300 per well. When fuel oil is used, approximately 40 barrels a day are consumed.

Water for drilling purposes is ordinarily obtained from water wells sunk to an average depth of 200 feet. These wells cost in the neighborhood of $400 each.

Slush ponds are extremely small, many wells having only one. Formations penetrated have good mud-making qualities and provide suitable mud for drilling, the weight of which runs from eight to ten pounds per gallon. Slight attention is given to mud as no high pressures are encountered. Slush pumps are ordinarily 12 by 6¾ by 12 in size.

There are no hard formations to penetrate. Bits now in general use are the fish-tail and other types of drag bits easily reconditioned. In the lower few hundred feet of hole wells penetrate what are known as the Pecan Gap and Austin Chalk, customarily drilled with a disc bit. Drilling into the pay sand is done with rotary tools, after which the rotary pipe is taken out and the well tubed with 2½- or 3-inch tubing.

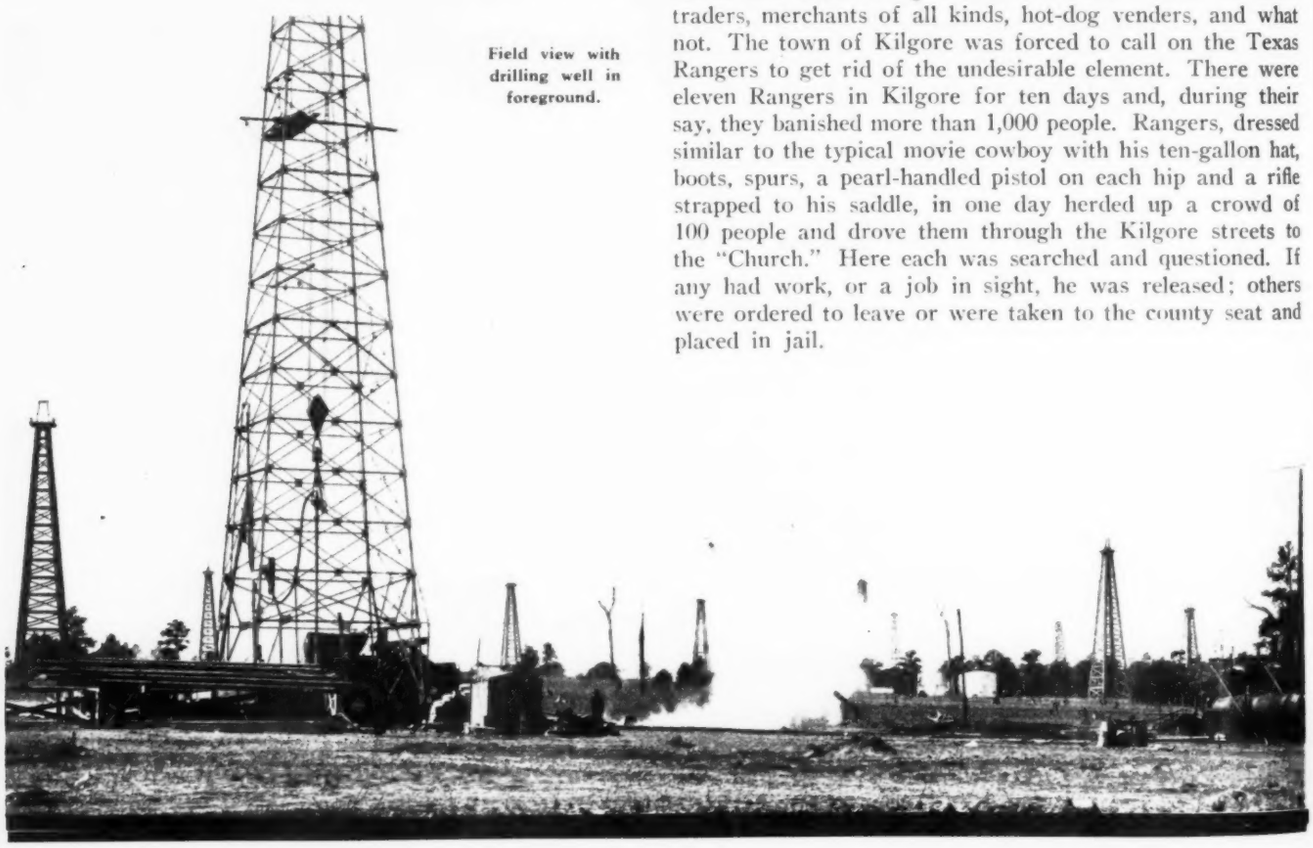
Wells are washed in with clear water pumped into the casing head, flushing the rotary mud out through the tubing. Rock pressure in this area is low, and the volume of gas produced with the oil is relatively small. For this reason it is often necessary to swab a well through the tubing to start the oil flow after washing out the rotary mud.

What has been said thus far pertains to methods of drilling, but the "real" problems of the East Texas fields have not yet been touched on. The major problem of both drilling contractor and producer is transportation. The average elevation of the area is approximately 400 feet above sea level; the soil, which is very sandy, contains alkali dust, an admixture which a light rain converts to a quicksand. This article being written during the rainy season, the roads have become almost impassable for trucks, and only mule teams can be used for moving equipment from railroads to the fields. There are five towns located conveniently to the pools: Henderson, Kilgore, Longview, Marshall and Tyler. Trucking and teaming contractors are available in each of these. In Kilgore one contractor has 800 head of mules and it is not uncommon to see as many as 60 head of mules hitched to one boiler. In some cases, they are able to travel only a few miles a day because of the mud.

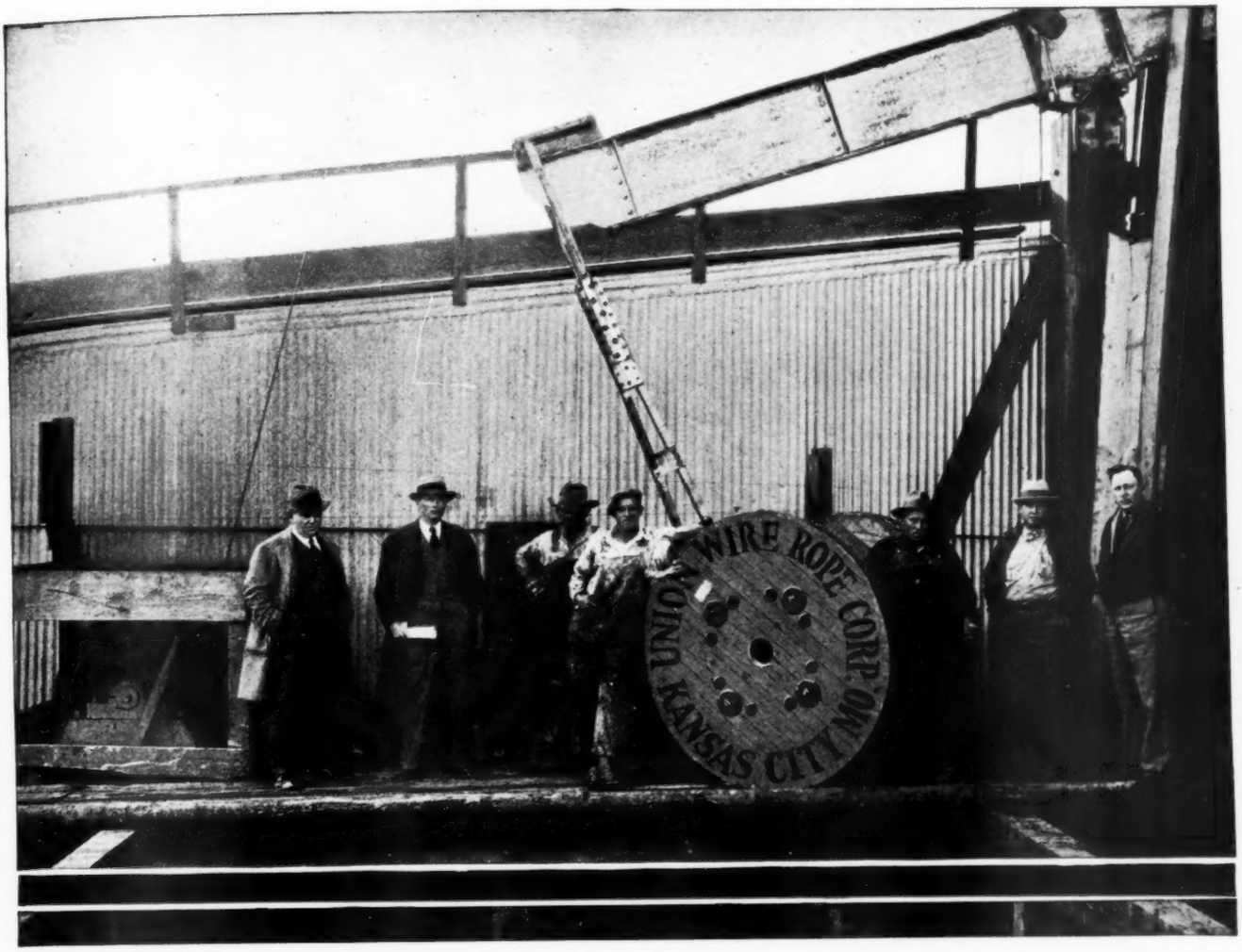
Regulations of the Texas State Highway Patrol are very strict. If a wagon or truck is not loaded in accordance therewith, teams are held up in front of the "Church" (a building formerly used for religious services but now police headquarters in Kilgore) while the owner of the material makes a trip to district headquarters of the highway department at Tyler, 45 miles away, to attempt to get a special permit to use the highway. Generally a permit is issued but warning against returning for a second accompanies it. Dozens of highway patrolmen carry a portable set of scales for weighing loaded wagons and trucks, each wheel being weighed separately.

The second problem of no small importance concerns disposition of the oil after the well is brought in and flowing. To date there are few pipe lines leading from the field and oil, for the most part, is shipped in railway tank cars. No well in the field is being produced to capacity because of lack of loading and railroad facilities. This will be remedied shortly by pipe line companies completing lines into the field.

While all this work is being carried on in the field, the towns are endeavoring to care for the crowds of lease traders, merchants of all kinds, hot-dog venders, and what not. The town of Kilgore was forced to call on the Texas Rangers to get rid of the undesirable element. There were eleven Rangers in Kilgore for ten days and, during their say, they banished more than 1,000 people. Rangers, dressed similar to the typical movie cowboy with his ten-gallon hat, boots, spurs, a pearl-handled pistol on each hip and a rifle strapped to his saddle, in one day herded up a crowd of 100 people and drove them through the Kilgore streets to the "Church." Here each was searched and questioned. If any had work, or a job in sight, he was released; others were ordered to leave or were taken to the county seat and placed in jail.



Field view with drilling well in foreground.



Using UNION to Cut Wire Rope Costs at Hobbs, N.M.

UNION WIRE ROPE CORP.
TRADE MARK

The men in this picture, left to right, are:
H. R. (Hal) Gruber, Union Wire Rope Corp.
Bob Nix, National Security Oil Company
Walt Wise, Truck Driver
Blackie Chapman, Tooldresser, Oil Well Drilling Company
Harry Jerrens, Driller
G. C. Conrad, Oil Well Drilling Company
W. E. Cunningham, Union Wire Rope Corp.

Shown above is a well drilled at Hobbs by the Oil Well Drilling Company. Wherever you go you'll find experienced operators reducing wire rope costs by using uniformly dependable UNION Wire Lines.

UNION WIRE ROPE CORPORATION

3 North Madison Avenue, Tulsa, Oklahoma

Oil Country Sales and Export Office: 338 Kennedy Building, Tulsa, Oklahoma

Branch Office and Warehouse: Parker Abbott, Distributor, Portland, Oregon — San Francisco, California — Factory: 21st and Manchester, Kansas City, Missouri

JARECKI MANUFACTURING COMPANY

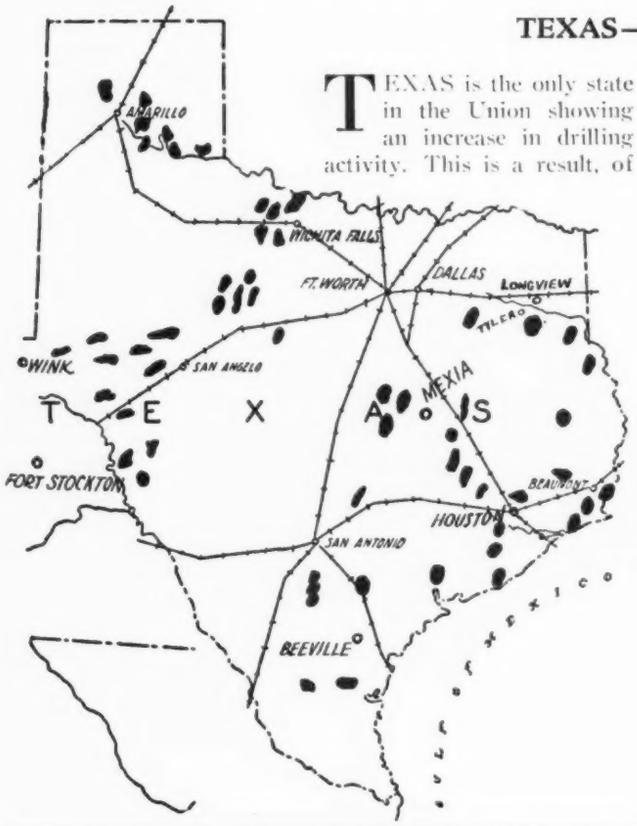
Mid-Continent and Eastern Oil Field Distributors ◆ ◆ ◆ Stocks at All Stores

UNION WIRE LINES

When writing UNION WIRE ROPE CORPORATION *please mention The Petroleum Engineer*

Latest Activities *in the* Oil Fields*

TEXAS—Production, 1930—290,720,000 Barrels



TEXAS is the only state in the Union showing an increase in drilling activity. This is a result, of course, of activities in the East Texas producing area, the center of attention in the United States today. Rapid drilling indicates that this area will shortly be at its peak production.

During March the state had a total of 408 new drilling permits and 315 tests completed. A check showed 161 rigs and 839 drilling wells in the state, both cable and rotary tools being used.

A tabular review of the state's active areas follows:

	POOLS			
	East Texas	Gray County	Van	Refugio
Number of Permits	174	2	9	....
March Completions	63	8	11	9
Number of Rigs	124	12	2	3
Number Drilling Wells	205	30	16	21
Gravity of Oil	40	42	36	26
Depth of Production	3600	2900	2600	6500
Type of Tools Used	Rotary	Rotary	Rotary	Rotary
Number of Casing Strings	2	2	2	3

CALIFORNIA

Production, 1930—228,612,000 Barrels

Heavy restrictions on drilling and production are holding California activity to a low figure, otherwise there are several very promising areas that could easily be drilled and produced.

The state last month reported 335 drilling wells and only 29 rigs. At the same time only 24 wells were being completed and 41 new drilling permits issued.

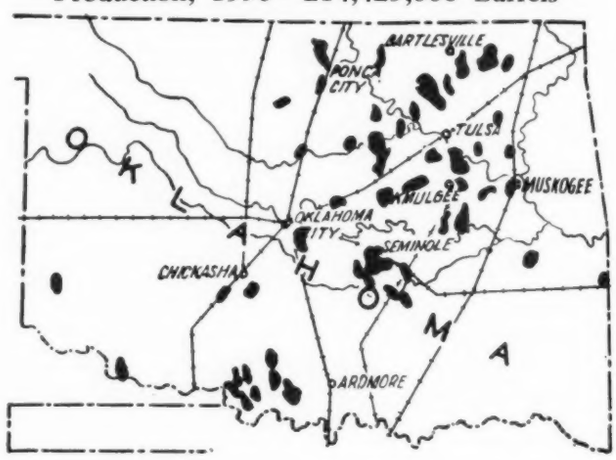
Active fields are declining as shown in the following survey:

	POOLS			
	Playa Del Rey	Long Beach	Kettleman Hills	Ventura
Number of Permits	4	3	....	1
March Completions	11	6	....	3
Number of Rigs	4	2	....	1
Drilling Wells	29	45	15	19
Depth of Production	6000	7000	8300	7800
Gravity of Oil	23	26	60	36
Type of Tool Used	Rotary	Rotary	Rotary	Rotary

* All statistics as of April 1st.
Denotes oil and gas fields.

OKLAHOMA

Production, 1930—214,425,000 Barrels

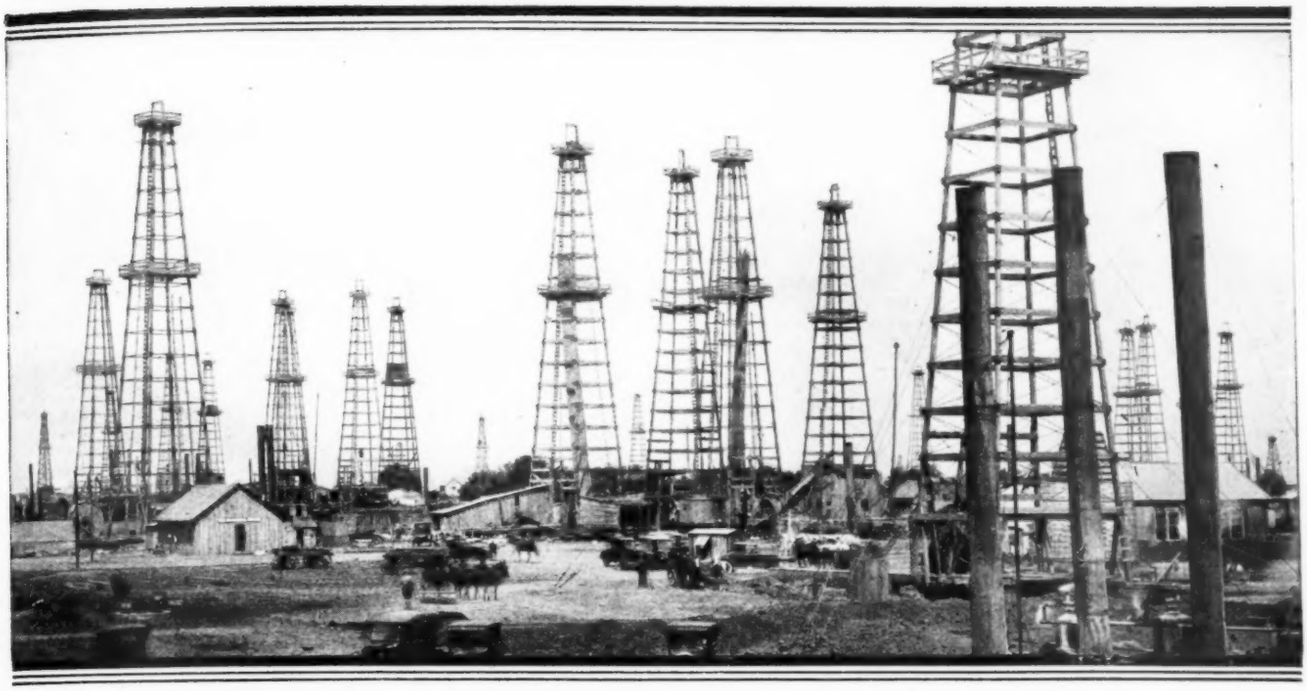


Oklahoma field activity has declined to its lowest point since early in 1926. Many wells in the state are shut down pending improvement in conditions. The state has 123 shut-down tests.

Following is a summary of Oklahoma field operations for the past 30 days, with Oklahoma City considered separately:

	Entire State	Oklahoma City
Number of Permits	78	13
March Completions	123	20
Number of Rigs	71	28
Number of Drilling Wells	175	58
Gravity of Oil	36	39
Depth of Production	Varies	6400
Type of Tool Used	Cable-Rotary	Rotary
Number of Casing Strings	Varies	3

Gravity of the oil varies in the state, but averages 36 degrees A. P. I.



SUPERIORITY OF HAYNES STELLITED TOOLS AGAIN PROVED IN TEST

. . . *Haynes Stellite Saves 5 Days' Drilling Time*

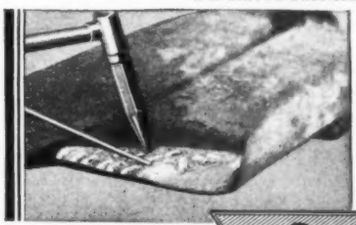
IN the Los Angeles basin, an operator drilled three wells with Haynes Stellited tools and two wells with tools hard-faced with another material. While the five wells were closely grouped, the 3000-foot level was reached in an average of 18 days with Haynes Stellited bits, and 23 days were required with the other bits.

Consider the advantages of 5 days less drilling time! It means 5 days less labor charges . . . 5 days less power consumption . . . 5 days less wear and tear on the drilling equipment . . . and the Christmas tree 5 days sooner.

It will pay you to investigate Haynes Stellite—the alloy which possesses 75 per cent more Red Hardness than any other hard-surfacing metal—for plain hard-facing, oil-well drilling tools or as a final coating on tools hard-set with Haystellite, the cast tungsten carbide diamond substitute. Write for our new book, "Haynes Stellite Products in the Oil Fields." Fill in and return the coupon today.

HAYSTELLITE TRADE MARK

A cast Tungsten-Carbide, a diamond substitute



HAYNES STELLITE TRADE MARK

A wear-resisting alloy of Chromium Cobalt and Tungsten

HAYNES STELLITE COMPANY

Unit of Union Carbide UCC *and Carbon Corporation*

CHICAGO DETROIT LOS ANGELES SAN FRANCISCO
CLEVELAND HOUSTON NEW YORK TULSA

General Offices and Works—Kokomo, Indiana

Haynes Stellite Welding Rod is also available from any of the 42 apparatus shipping points of The Linde Air Products Company

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Haynes Stellite Company, Kokomo, Indiana

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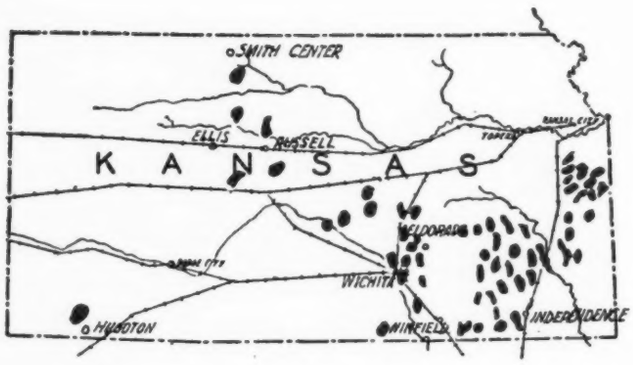
Company.....Position.....

Street Address.....

City..... State.....

When writing HAYNES STELLITE COMPANY *please mention The Petroleum Engineer*

KANSAS—Production, 1930—41,745,000 Barrels



Kansas had 34 permits, 50 completions, 81 drilling wells, 54 shut-down tests and 39 rigs last month. Both cable and rotary tools are operated in this state, with the former predominating.

Following is a survey of the active spots in the state:

	POOLS		
	McPherson County	Sedgwick County	Hugoton Field
Number of Permits	18	3	----
March Completions	17	9	2
Number of Rigs	7	2	4
Number Drilling Wells	36	6	7
Gravity of Oil	37	36	Gas
Depth of Production	2900–3400	2900–3250	2750
Type of Tool Used	Cab.-Rot.	Cab.-Rot.	Cab.-Rot.
Number of Casing Strings	2	2	2

ARKANSAS

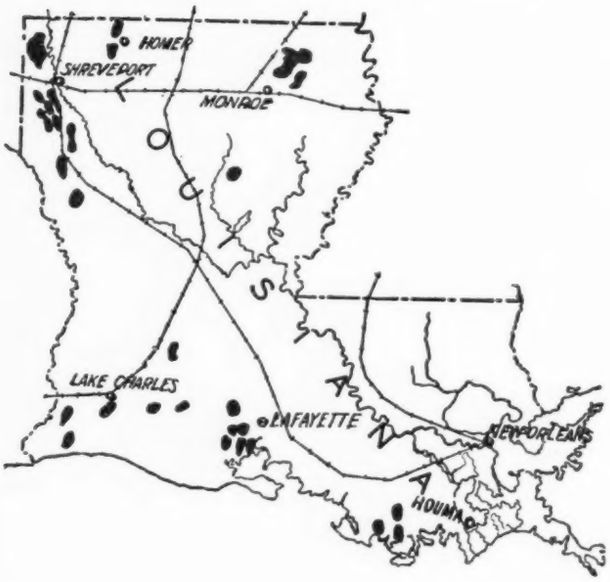
Production, 1930—19,680,000 Barrels

Summary of activity in the Arkansas oil fields the past month follows: 4 permits, 5 completed tests, 11 rigs and 41 drilling wells.

Rotary tools are used for drilling in this state, where frequent heavy gas pressures and soft, cavey formations are encountered in penetrating to the producing horizons.

LOUISIANA

Production, 1930—23,150,000 Barrels



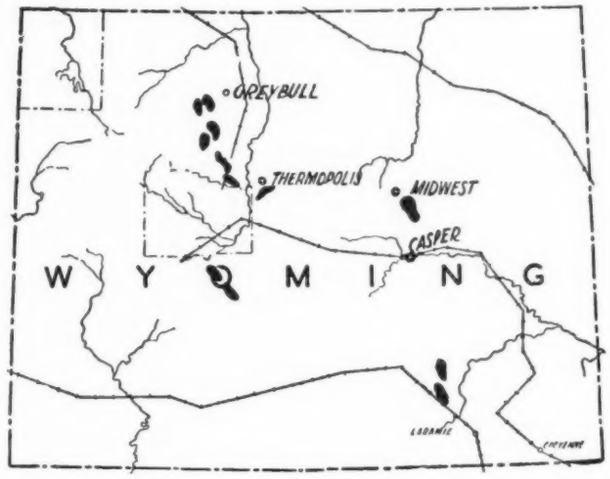
Louisiana had 96 drilling wells and 24 rigs last month. During the same period 39 tests were completed and 25 new drilling permits issued. Rotary tools and rigs operate in this state.

Mississippi, neighbor to Louisiana on the east, and one of the newest members of the oil producing group, had 6 completions, 7 rigs and 20 drilling wells.

WYOMING

Production, 1930—11,177,000 Barrels

There were 3 completions in Wyoming last month. The state has 12 rigs and 95 drilling wells. Both rotary and cable tools are operated, with cable tool installations predominating.



● **Denotes oil and gas fields.**

NEW YORK

Production, 1930—3,825,000 Barrels

PENNSYLVANIA

Production, 1930—12,810,000 Barrels

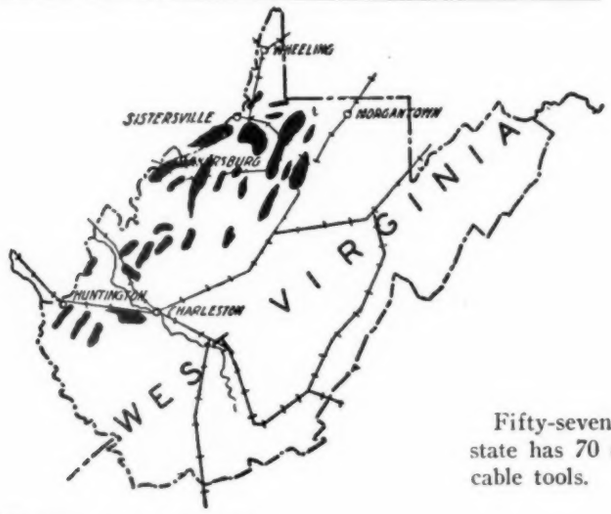
Pennsylvania had 46 completions last month, 12 rigs and 55 drilling wells. Interest in Pennsylvania is centered at Tioga, where one of the largest gas wells completed in recent years has been successfully controlled after blowing wild for two weeks.

New York State had but 5 completions last month.

ILLINOIS

Production, 1930—5,695,000 Barrels

During March Illinois had a total of 6 tests completed, and 3 new rigs were built. Drilling activity consisted of 20 operations. All of the drilling is carried on with cable tools. Producing depths in the state are shallow and no unusually hard formations are encountered.



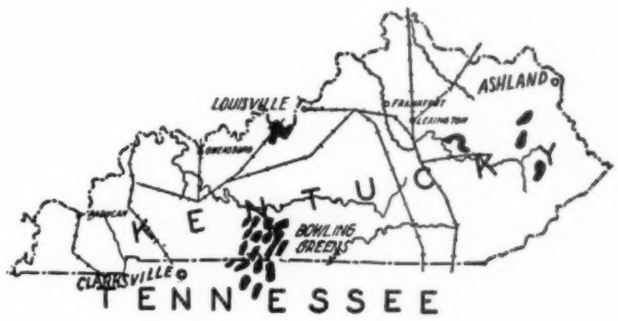
● Denotes oil and gas fields.

KENTUCKY

Production, 1930—7,360,000 Barrels

Kentucky had 146 drilling wells and 9 rigs. There were 57 tests completed. Tennessee reported 16 drilling tests with no completions and rigs.

Drilling in both states is done with standard tools.



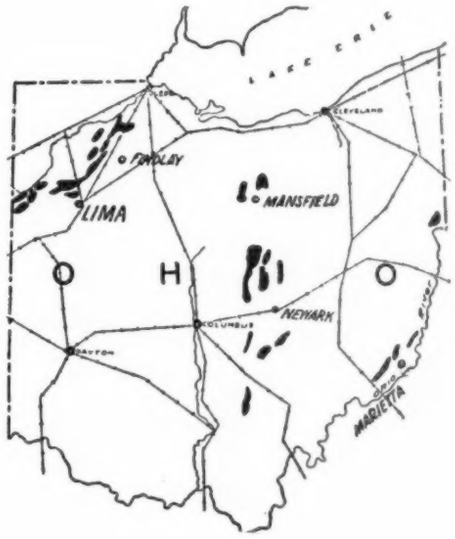
TENNESSEE

Production, 1930—20,000 Barrels

OHIO

Production, 1930—6,525,000 Barrels

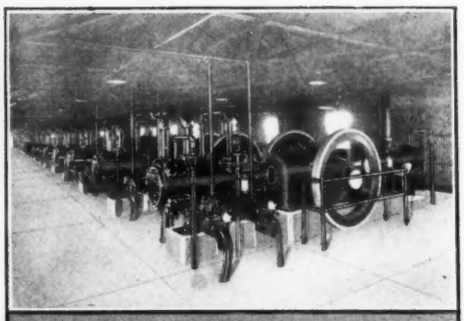
There were 109 completions in the oil fields of Ohio last month. The state had 63 rigs and 183 drilling wells. Cable tools are employed for drilling operations.



WEST VIRGINIA

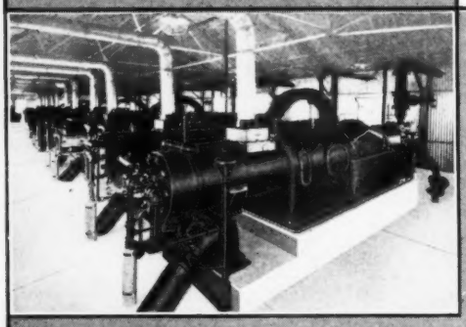
Production, 1930—5,100,000 Barrels

Fifty-seven wells were completed in West Virginia during March. The state has 70 drilling wells and 32 new rigs. Drilling is done by means of cable tools.

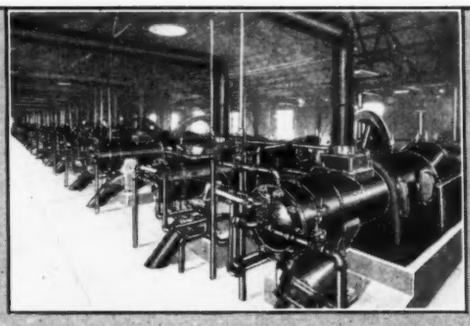


Oklahoma City plant with 100 H. P. Clarks

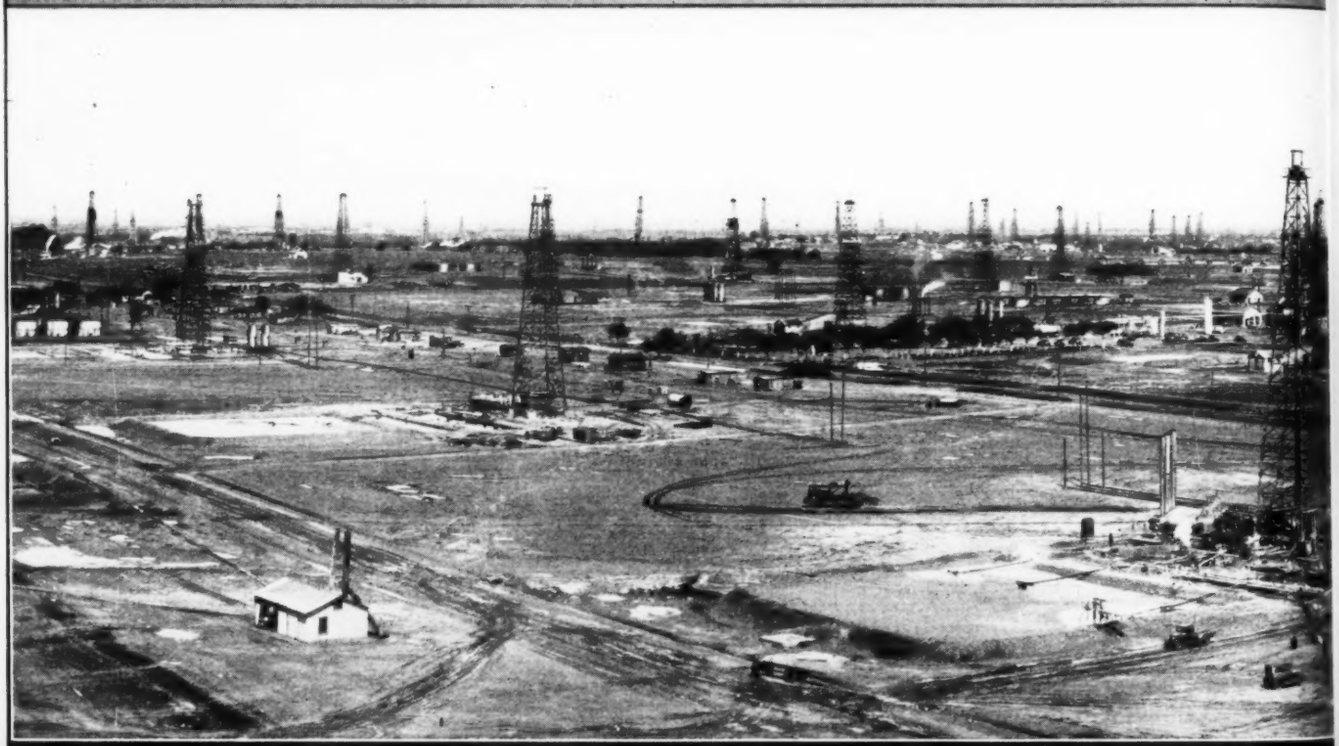
13,300 h.p. at Oklaho



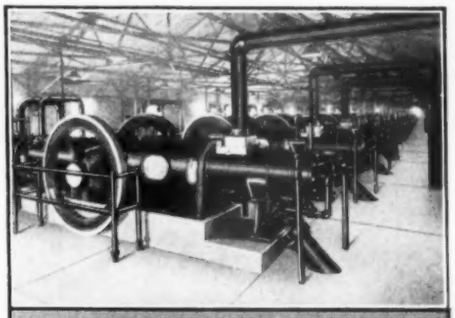
200 H. P. Clark "Super 2" twins at Oklahoma City



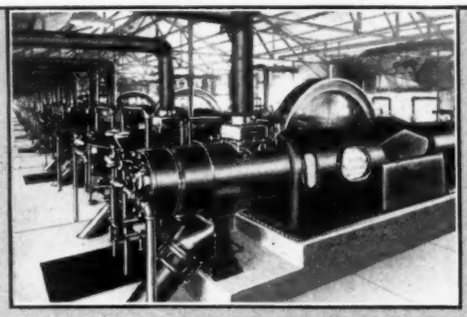
Sixteen Clark 200s and three Clark 100 H. P. "Super 2s"



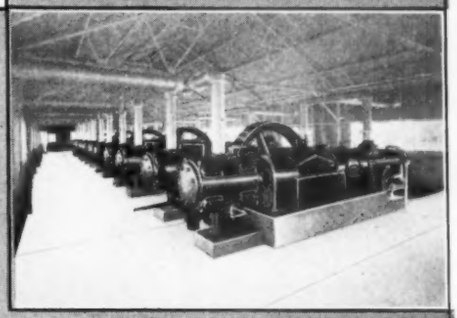
# of CLARKS
ma City—



Clark 100 H. P. "Super 2s" at Oklahoma City



Fifteen Clark 200 H. P. "Super 2s" and one 100 H. P.



Clark 200 H. P. Twin "Super 2s" in Oklahoma City Plant

The amazing Oklahoma City oil field is featured by enormous potential production, extremely high pressures, deep holes, modern methods — and CLARK Engines.

CLARK BROS. COMPANY » » Olean, New York

Export Office: 150 Broadway, New York City

Warehouses: Tulsa; McCamey and Sweetwater, Texas; Artesia, New Mexico.

Mid-Continent Sales Offices: Tulsa, Oklahoma; Houston, Texas.

California: Smith, Booth, Usher Company, 228 S. Central Ave., Los Angeles.

NEW MEXICO

Production, 1930—10,235,000 Barrels

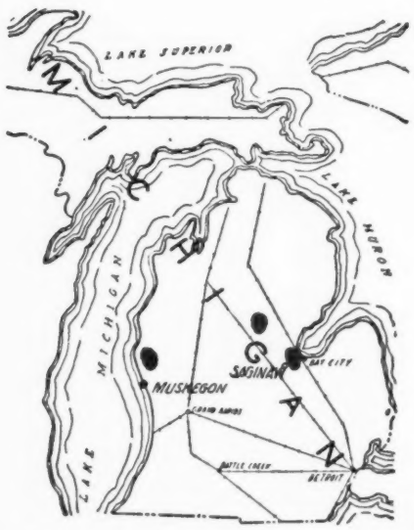
There are only 49 drilling wells in the state of New Mexico at this time, the smallest number since shortly after the discovery of the Hobbs field. During the past month there were only two tests finished and 11 new rigs erected.

Activity in the Hobbs field has declined until there are now but a dozen drilling wells. This decline is largely due to heavy restrictions on production and drilling operations.

Contractors in the Hobbs field use rotary tools, but cable tools are operated in other parts of the state. The producing horizon at Hobbs is 4,200 feet below the surface and several upper gas sands are penetrated.

MICHIGAN

Production, 1930—3,525,000 Barrels



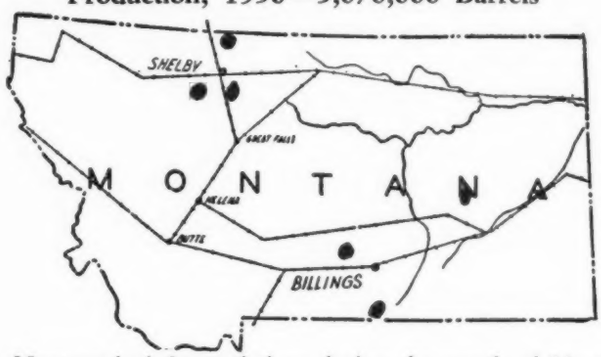
Drilling operations in the state of Michigan continue to decrease slowly as there are no new field developments of unusual interest. Last month there were only three completions in Michigan fields, while 96 drilling wells and 62 rigs were listed on the drilling report.

Practically all of the wells in the state are drilled with standard cable tools.

● **Denotes oil and gas fields.**

MONTANA

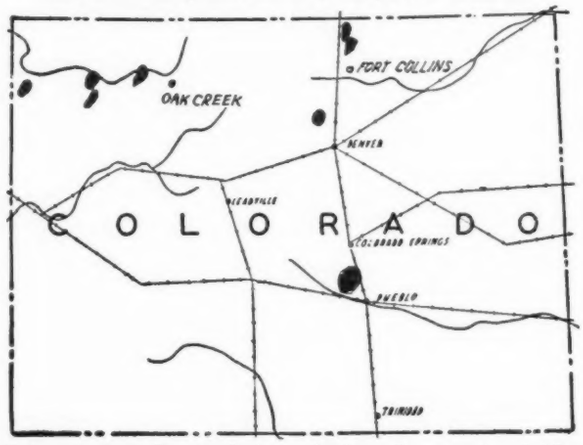
Production, 1930—3,070,000 Barrels



Montana had 6 completions during the month of March, during which time it had 10 new rigs and a total of 60 drilling tests. Cable tools are commonly used in the state for making hole.

COLORADO

Production, 1930—1,644,000 Barrels



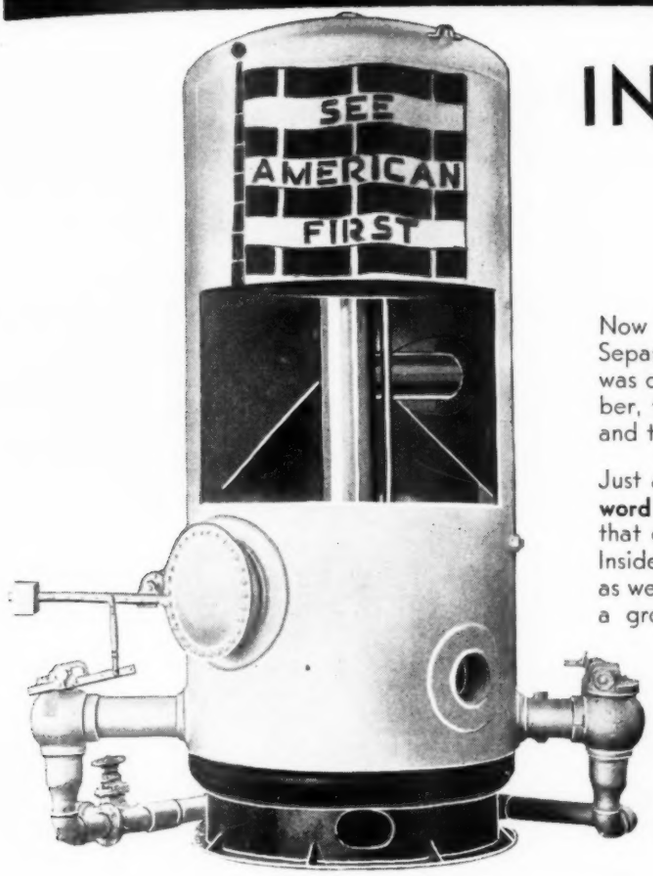
Colorado had 5 completions during the month of March. Drilling activity is made up of 13 rigs and 71 drilling wells. Both rotary and cable tools are to be found working in the state, where production is found at both shallow and deep levels.

INDIANA

Production, 1930—1,000,000 Barrels

Indiana completed 14 tests during the past 30 days. It has 47 drilling wells and two rigs.

Cable tools are used by operators working the state. Production is found at shallow depths and no heavy gas pressures are encountered.

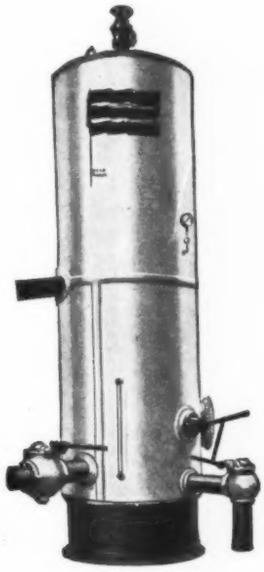


INSIDE *and* OUTSIDE!

Now you may see what's on the inside of the AMERICAN Separator. Here is a view of a cut-away of the Separator that was on display at the Oil Show. You may see a large oil chamber, the oversize float that's on the inside, the Disc Foam Baffle, and the Centrifugal Force Breaker in the oil chamber.

Just above, but not distinguishable in this photograph, is **the last word in Oil and Gas Separation**—The B.S.&B. Spray Condenser, that completely strips the remaining oil from the gas.

Inside, there is efficiency. Outside, as well, with lower fittings that allow a greater convenience in hook-up and savings in time and pipe materials. And besides, these Separators may be rolled like a barrel, when being transported, for there's nothing to break off or become damaged.



May Be Rolled Like a Barrel

The Improved American Oil and Gas Separator

Equipped with the B. S. & B. Spray Condenser

If you are interested in efficiency, you'll find it in this Improved Separator. The inside man-size float is an important feature, for it works more automatically, assures quicker, and more positive operation in opening and closing the oil valve, and thereby tends to prevent gas from leaking into the stock tanks. It assures a far greater capacity than the small outside float that is now obsolete, as far as AMERICAN Separators are concerned. This float, the B.S.&B. Spray Condenser, and the other features provide ample efficiency.

If you are interested in strength, you'll find it in these Separators, manufactured of flange quality steel of extra thickness with a factor of safety of four; semi-eliptical heads one-eighth inch thicker than the shell, as recommended by the A.S.M.E. Boiler Code. Every AMERICAN is hydrostatically tested to twice the maximum working pressure; electric automatically welded seams equaling the strength of the plate. The care used in the selection of raw materials and in the fabrication of the Improved AMERICAN is your assurance that it will meet the most severe field conditions to which it may be subjected.

We'd like to SHOW YOU what the AMERICAN would do for you, and should like to tell you more about it. May we do so through a Representative, a letter or literature? Please address Dept. CA-15.

American Tank & Equipment Corp.
A SUBSIDIARY OF
BLACK-SIVALLS & BRYSON, Inc., Bartlesville, Okla.
OKLAHOMA CITY — OKLAHOMA

(Formerly American Tank Company)

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Progress of Major Pipe Line Work

By J. H. DAMERON

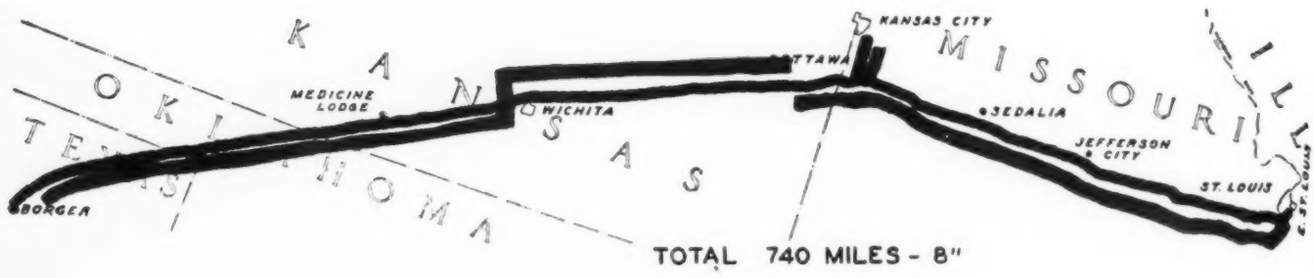
GREAT LAKES PIPE LINE CO.

CONSTRUCTION work is now starting on numerous pipe line projects which had been held in abeyance pending arrival of spring weather. At the same time, 1930 major projects extending over to this year are being speeded to completion.

Great Lakes Pipe Line Co. has completed line construction on all of its north and south main gasoline carriers. The 6-inch line running east through Iowa to Chicago has been completed across the Mississippi. Construction of this line from Cordova, Ill., to Chicago is well under way. Work started April 15 on the 70-mile, four-inch lateral running east from El Dorado, Kans., to the main line, and construction on the 115-mile, four-inch lateral to Omaha markets will probably start at the same time.

Some time ago the Great Lakes transporting company started pumping gasoline to Kansas City, Mo. The stations on this line are powered with Diesel engines driving reciprocating pumps. Main line stations between Ponca City and Kansas City were completed about six weeks ago and all other stations, except two in Illinois, are under construction. Sites have been purchased for these two stations and construction will start the latter part of April.

PHILLIPS PIPE LINE CO.



With the exception of a few miles near St. Louis, Mo., the Phillips Pipe Line Co.'s eight-inch welded gasoline line from the Texas Panhandle to St. Louis is complete. All of the butane-fueled gas engines, centrifugal pump stations have been completed and are ready for service. The line is in operation as far east as Wichita, Kans., and the 53-mile, six-inch lateral being built by Kelley-Dempsey, contractors, is finished to a point near the Kaw River at Kansas City. Approximately 30 days' construction will be required to finish the communication system for the line.

Indicates completed portion of line.
Indicates proposed route of line.

OXWELDING
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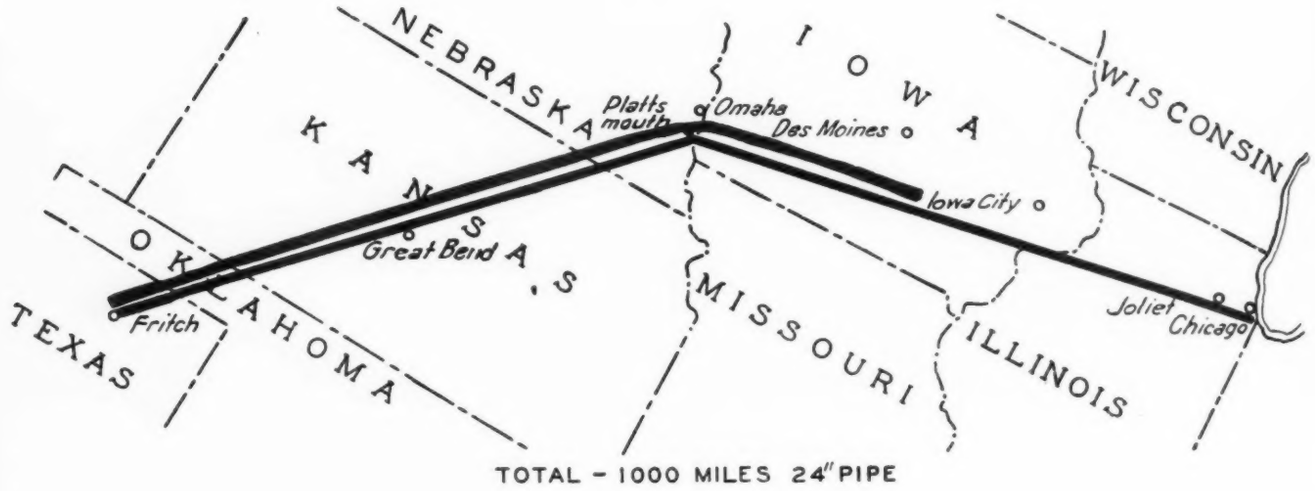


The nation's largest gas line project, the Texas Panhandle-Chicago, Ill., 24-inch gas line being built by the Continental Construction Corp., is rapidly approaching the line's terminal. With a better "break" in weather fast construction time will be made to complete the section through Iowa. Contract for construction of the remaining 155 miles through Illinois was awarded to Williams Bros., Tulsa. To date a section comprising more than 350 miles of main line, as well as 50 miles of the 24-inch gathering system has been tested. Five of the compressor stations are practically complete and three others are under construction. Contract for the initial station, which, according to plans, will be the world's largest compressor station, is to be awarded late in April.

PANHANDLE-EASTERN PIPE LINE CO.

It is expected that construction work on the Panhandle-Eastern Pipe Line Co.'s transmission system from the Texas Panhandle to Indianapolis, Ind., will resume before the end of the month. The incomplete section in Illinois, which has been delayed by right-of-way difficulties, will be built with 20-inch pipe. The remainder of the line was built with 24- and 22-inch.

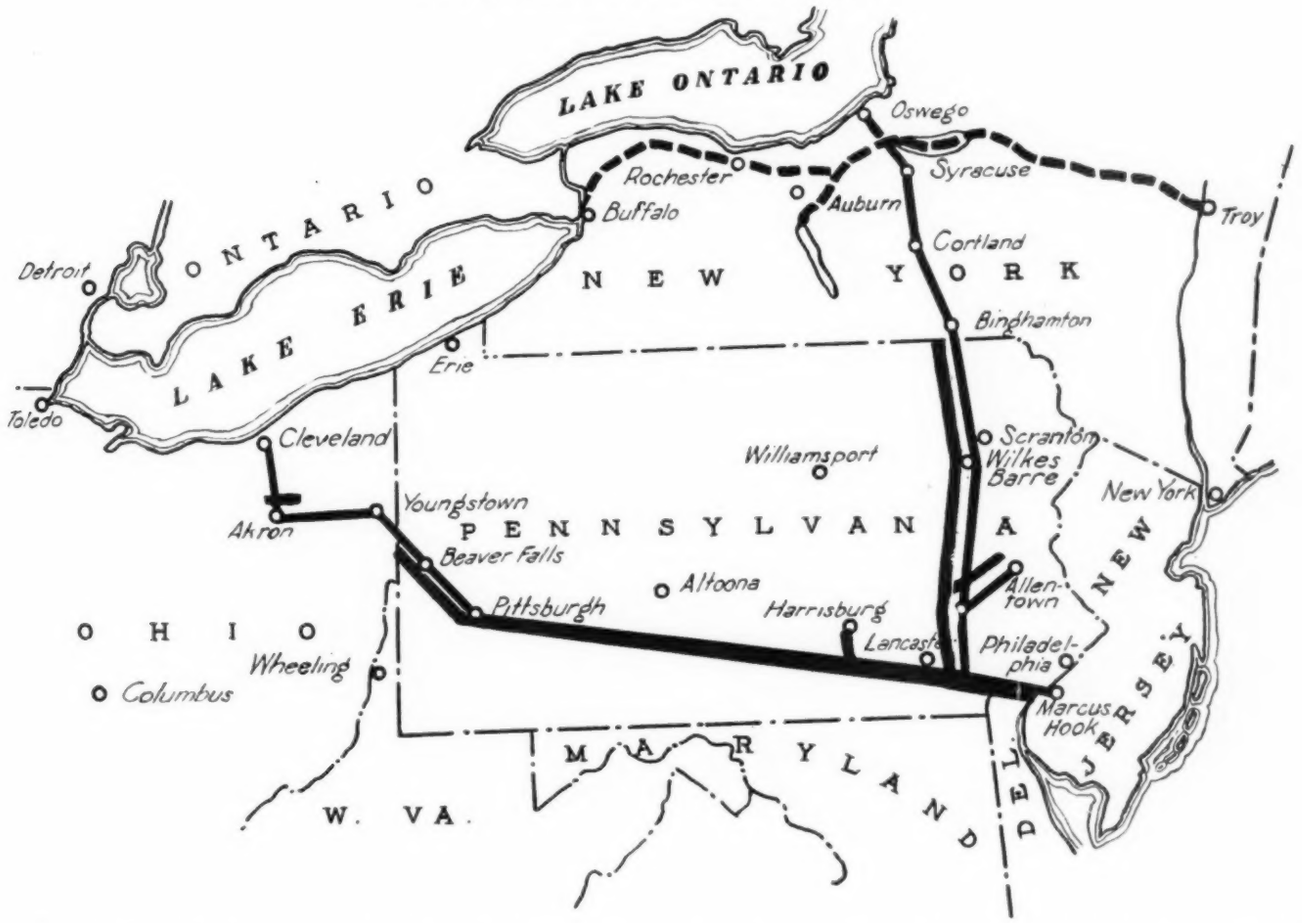
Approximately 20 miles of pipe has been strung east of the Mississippi River and machinery is on location. It is reported this line may be extended east from Indianapolis to tie in to the Columbia Gas & Electric system near Muncie, Ind. The Columbia Gas & Electric Co. owns half interest in the new line.

Indicates completed portion of line.
Indicates proposed route of line.

GULF PIPE LINE CO.

By the latter part of the month Gulf Pipe Line Co. expects to have its eastern main line system entirely completed. Last winter the company finished a 10-inch welded oil line from the Mid-Continent fields to Spencerville, Ohio, where it connected with another line. To complete the project 50 miles of eight-inch line is being built to Cincinnati, where a refinery is under construction.

SUSQUEHANNA PIPE LINE CO.



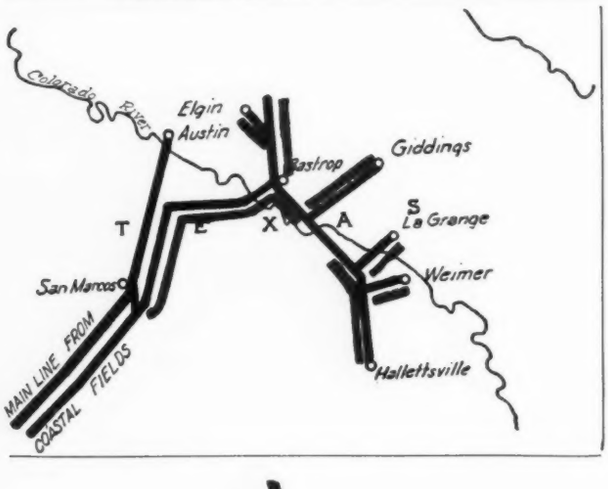
Resuming work after a winter shutdown the Susquehanna Pipe Line Co. has two crews working on the west end of its gasoline system. This section of the line will terminate at Cleveland and is being built with six-inch pipe. On the north end, the construction of the six-inch main from the New York state line to Syracuse will be started some time during the latter part of April. A portion of this system has been in use for several weeks.

Indicates completed portion of line.
Indicates proposed route of line.

SOUTHERN FUEL CO.

In California the Southern Fuel Co. is starting work on its 185-mile, 26-inch gas line from Kettleman Hills to Los Angeles and Long Beach. Upon completion this line will be the longest 26-inch diameter line in existence. It will be constructed with electric welded pipe with all joints welded.

Progress on the Southern Fuel Co.'s line will be retarded by mountainous country. It is estimated that the joint project of the Southern California Gas Co. and Southern California Edison Co., Ltd., will cost $7,000,000. The line will have a capacity of 130,000,000 feet daily, and will serve the Los Angeles area, as well as the Edison Co.'s huge generating plant at Long Beach.



UNITED GAS CORP.

Being built through swamp country and rice fields, the United Gas Corp.'s main line system in South Louisiana is progressing rapidly. Most of the 158-mile section of main line from Kirbyville, Texas, to Franklin, La., has been laid and work on the 265 miles of laterals is well under way. Two contractors, F. C. Youmans Co. and The Sexton Corp., Houston, are building the line under the direction of The Texas Construction Corp., United subsidiary.

The extension of the main line system north from Gulf Coast fields to Austin was completed early in April when the 100 miles of line went into service.

Indicates completed portion of line.
Indicates proposed route of line.

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J. P. STEELE, 305 Petroleum Bldg., Ft. Worth, Texas.

District Offices:

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FOR over thirty years we have always aimed to produce line pipe and casing of the highest quality and workmanship—and at the same time maintain the quickest and best service possible to every customer. Our distribution centers are strategically located throughout the oil and gas fields of the United States.

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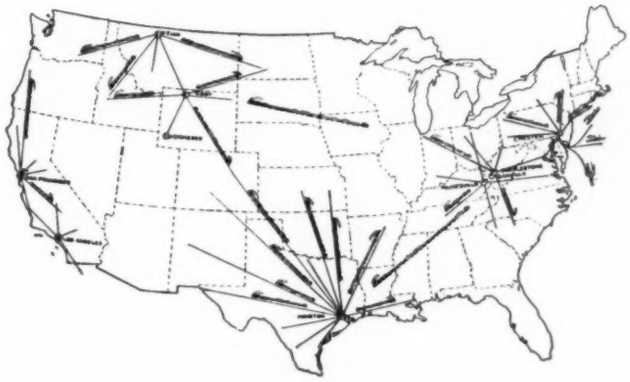

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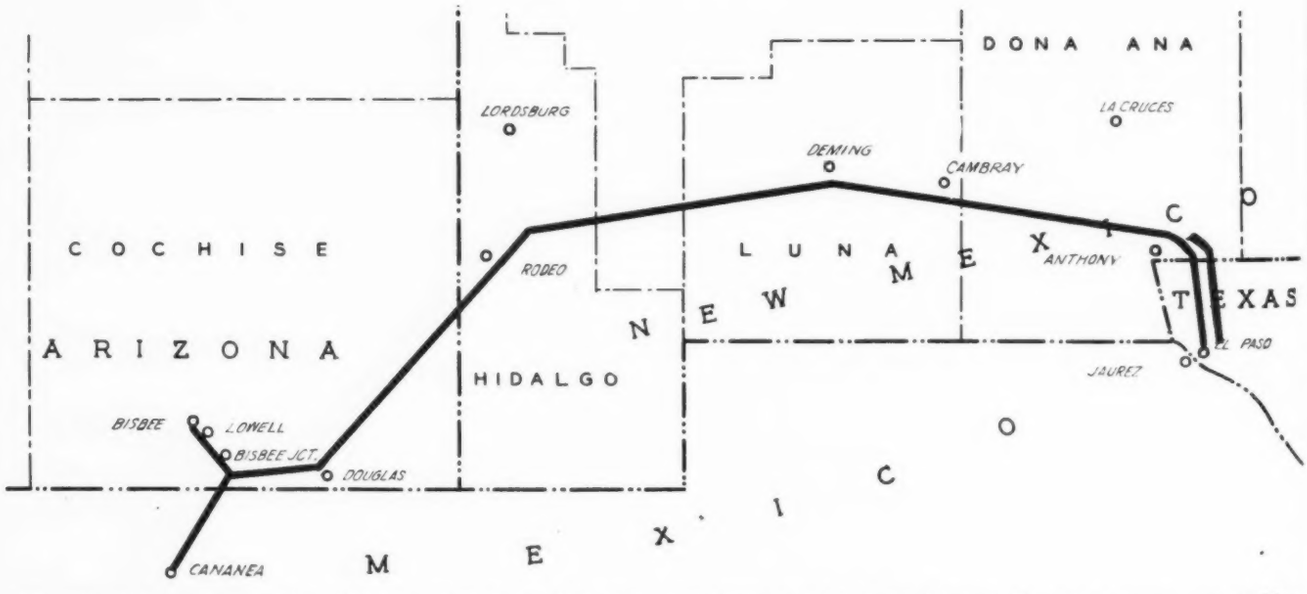
COLUMBIA GAS & ELECTRIC CO.

In the eastern territory the Columbia Gas & Electric Co. has started construction of a 350-mile, 20-inch gas system to bring gas from eastern Kentucky to Washington, D. C., and to the company's main line system at Philadelphia. Just now three crews are working in Virginia along the Blue Ridge Valley. This line will offer extremely difficult construction problems in the mountainous country. Contract for this section will probably be let during April.

In mountainous country the line will incline at a 45-degree angle. The Columbia Co. is using its own construction crews to build the east end of the system.

WESTERN GAS CO.



Construction work on the Western Gas Co.'s 275-mile, 12-inch gas line running from El Paso, Texas, and Douglas and Bisbee, Ariz., to industrial connections in Cananea, Mexico, is well under way. The $6,000,000 project is expected to be completed by August 1. This line will be supplied with gas from the El Paso Natural Gas Co.'s trunk out of New Mexico and terminating at El Paso. Bechtel and Kaiser, Ltd., San Francisco, Cal., were awarded the contract to construct the entire line.

Indicates completed portion of line.
Indicates proposed route of line.

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This handle's ON TOP

EVERYTHING above the bench! No fumbling—no groping. The handle's right there—where you want it.

The pipe worker who has never used Williams' "Vulcan Superior" Vise has a new experience in convenience coming to him.

And this vise has other definite advantages; it takes pipe a half inch larger than corresponding sizes in other vises; the jaws are reversible, giving double life. "Vulcan Superior" is wholly made of tough wrought steel—*drop-forged* base, jaws, handle and chain-arm. Ask for literature.

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The Month's Activities *in* Refining*

By F. R. STALEY

REFINERIES in the Eastern Division increased crude runs during the past month from 70.8 to 74.8 per cent of capacity. The Central Division showed a slight increase, and in the Western Division figures were unchanged.

Foster Wheeler Corporation will construct two absorption and stabilizer plants for the Pure Oil Co. refineries, one at Smith's Bluff and the second at Marcus Hook, Pa.

Many of the large refineries are constructing vacuum units for rerunning pressure distillate. The light constituents can be distilled from this product at reduced temperature, producing a product superior to that obtained under atmospheric pressure.

Slack Petroleum Co. will build a 2,500-barrel refinery near Longview, Texas, and the Republic Oil Co., a subsidiary of the Big Lake Oil Co., is constructing a 5,000-barrel refinery at Texas City, Texas.

To process distressed crude, a new refinery is planned by J. E. Perkins and Charles Brockler of Kansas City. This will be a small plant erected near Nowata, Okla.

The Conrad Oil & Refining Co. of Conrad, Mont., is erecting a new 1,000-barrel distillation unit and otherwise improving its refinery.

The Huasteca Petroleum Co., a Standard of Indiana subsidiary, is enlarging its refinery at Tampico, Mexico.

Officials of the Hope Engineering Co. have inspected a site near Artesia, N. M., for the erection of a refinery.

Several small refineries will soon be built in California. The L. O. Oil & Refining Co. has started construction of a 500-barrel unit near Fruitvale and the Vulcan Refining Co. will erect a plant near Vernon in the near future.

The British-American Oil Co. has purchased about one million barrels of East Texas crude, to be processed in its Canadian refineries.

The Tide Water-Associated Oil Co. has announced a new Veedol motor oil which is manufactured from 100 per cent Pennsylvania crude. Over two million dollars have been invested in new equipment in the Tide Water refinery for manufacturing this new oil.

The Standard Inspection Laboratory of the Standard Oil Development Co. has announced two Standard reference fuels, "A" and "B", which are available to testing laboratories for knock rating tests.

The annual spring group meeting of the committees of the American Society for Testing Materials was held in Pittsburgh, March 16 to 20. Problems common to the automotive and petroleum industries were discussed at length in meetings of Committee D-2 on Petroleum Products and Lubricants.

Natural Gasoline

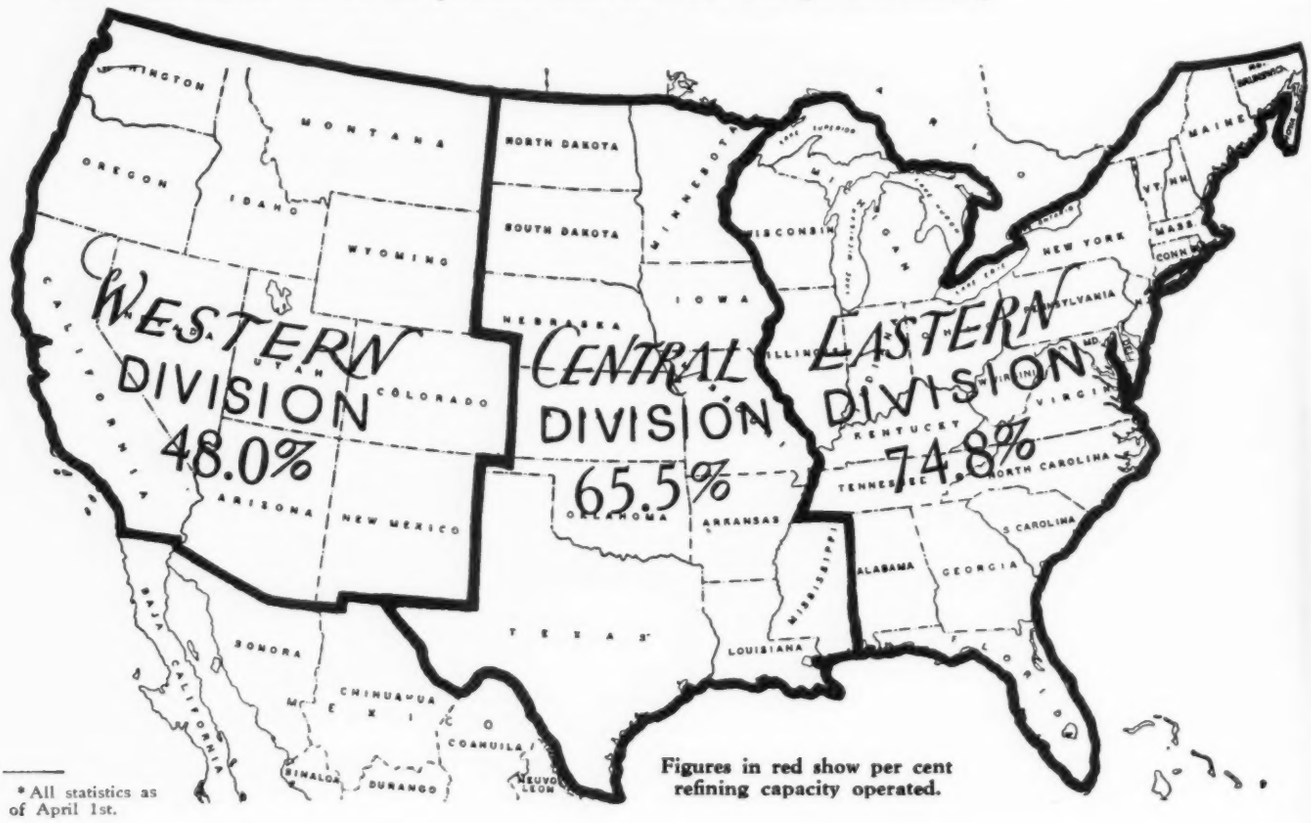
The Pure Oil Co. will add two new units to the Van gasoline plant.

The first natural gasoline plant for East Texas will be built by the Magnolia Petroleum Co. near Kilgore, according to a recent report. Tests on the gas in this field show a content from two to three gallons per thousand cubic feet.

The Eason Oil Co. of Enid is building a small natural gasoline plant in Logan County, Okla.

Two California towns, Barstow and Victorville, will be supplied with propane gas, to be shipped in tank cars to central plants located in each town.

The Texas Co. has purchased 500 cars of natural gasoline from the Empire Oil & Refining Co. for delivery over a three months period. The material specified is grade AA with a 96 per cent recovery.



Figures in red show per cent refining capacity operated.

*All statistics as of April 1st.

OKLAHOMA CITY'S Regulations Against Hazards *of* High Pressures

DEVELOPMENT of high pressure oil producing areas in thickly populated districts is necessarily responsible for unusual fire and damage hazards that constantly threaten destruction to buildings and endanger human life. Utmost precaution, special equipment and ingenious mechanical engineering methods are called forth by this condition.

The southeast sector of Oklahoma City is now dotted heavily with giant drilling rigs and high-pressure wells. In fact, there have existed few pools in which such extremely high pressures have been encountered. No previous one has underlaid such a thickly settled area, almost all having been located near small towns.

Sand particles from a depth of 6,400 feet emanating from a high-pressure well naturally are destructive to equipment and often cut out the sturdiest of hook-ups. It is from the extreme hazard created by the inflammable spray of oil and gas often covering a wide area, however, that the city officials as well as all oil companies constantly attempt to protect the citizens of Oklahoma City.

The city has passed a number of regulations to aid in securing safe and sane operation, prevent wild wells and eliminate all possible fire hazards. The close co-operation of oil companies with the city has made this program so successful that, when a well got out of control recently and for a week sprayed one section of the city with crude oil, no loss of life or serious fire damages were reported.

A typical drilling location in city area.

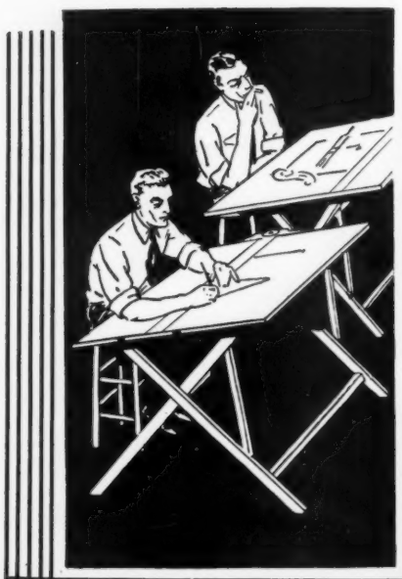
Below—Manifold foam valves at stock tank battery.

The carrying out of a safety program is under the jurisdiction of the city drilling commission and the city fire department. The city commission controls drilling activities and takes care that the wells are properly equipped, while the fire department inspects wells in search of fire hazards. Both departments make inspections and recommendations on each well, especially just prior to its completion.

Drilling operations within the city limits are restricted to zones U-7 and U-8. These are in the producing area but are sparsely populated. By limiting drilling to these zones, uncontrollable activities throughout the entire southeastern section of the city have been averted.

Only one well is allowed to each block in unplatted areas and no tract of less than five acres to a well is permitted. It is necessary to secure a drilling permit from the city commission before starting a well, and the application for this must be accompanied by full information as to the location of the well, dimensions of the lease and the equipment to be used. The hole must be not closer than 50 feet from the edge of the property line.

All derricks are of steel, with a concrete foundation of dimensions not less than 8 by 8 by 6 feet for each derrick



Axelson DESIGN

Interprets production facts into terms of pumps...

INCORPORATING the best features of both insert and liner plunger pumps, the Axelson Traveling Type Liner Insert Pump has been designed as a forward step in the pumping field. Pumping conditions constantly change and Axelson engineers, conversant with these changes, have built into this pump, features which mean definite dollars and cents economies for the producer.

Cups have been eliminated and the metal-to-metal principle for working parts is carried out with the steel plunger operating against chrome nickel semi-steel liners. The well-known Barnwell plunger feature has been built into the pump by means of special cage construction, minimizing oil emulsion, eliminating "gas locks" and facilitating the handling of sand. Provision is made for tightening the rod string or, in case of excessive sand conditions to avoid a "wet" tubing job. Axelson representatives will be glad to give full details concerning the savings that can be derived from installing an Axelson Liner Insert Pump.

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STRAIGHT FACTS
This is the sixth of a series and the 1st ad on insert liner pumps

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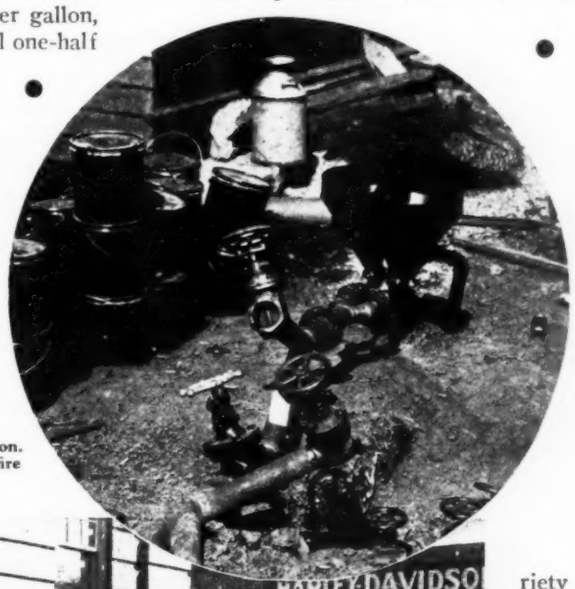
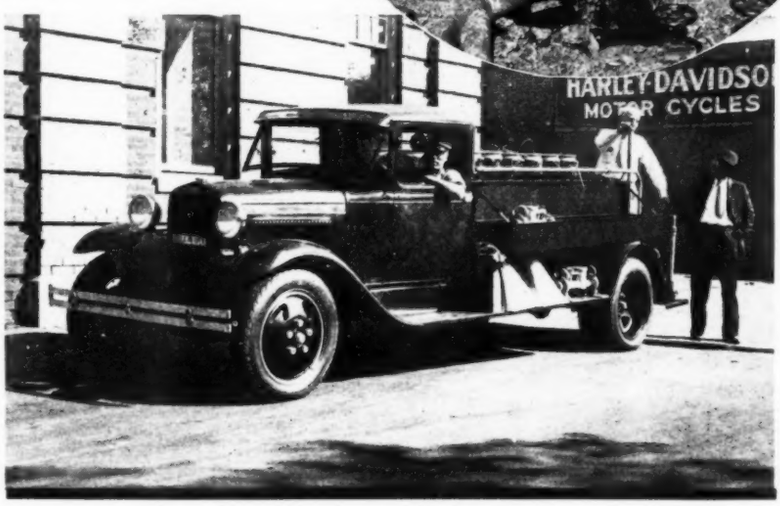
leg, and are braced by 12 guy wires. The dead load capacity and height of the derricks are specified by the commission. Cellars must have minimum dimensions of 6.3 feet wide by 6.3 feet long by 16 feet deep. Bottoms and runways must be of concrete. Casing, valves and fittings of a specified test pressure and weight add security. Three master gates, securely anchored, are required for each casing string. Separators must have individual vents and be not less than eight inches in diameter nor closer than 75 feet from the well, and at least 60 feet high.

Other requirements are that drilling boilers be placed 70 feet from the well, steam exhausts be muffled; also that rotary drilling mud of nine and one-half pounds per gallon, be used below 3,000 feet, with an increase to 11 and one-half pounds when a depth of 5,000 feet is reached.

Work tanks are spaced according to their size, 2,000-barrel individual tanks being the largest permitted, while a tank battery is limited to 20,000 barrels. Tanks are equipped with ample vent lines and tank pits must have the regulation annular space as designated by A. P. I. standards. All tanks are fenced and placarded with warnings of danger. No casinghead gasoline plants are permitted within the city limits. Wells are not to be allowed to blow into the air, and must be completed in a manner that prevents the escape of gas and oil. Any residue oil left in the pits after completion must be removed at once. Derrick floors and the area surrounding the well are to be kept clean and all unnecessary planking and housing hauled away. Producing operations must be halted during an electric storm.





Circle—Foam generator installation. Below—One of Oklahoma City's fire trucks.

Field restrictions for the completing of a well include provision for the barricading of streets in the vicinity and the posting of warning signals. An area of a block in each direction from the well is roped off and trespassers are not permitted inside. All fires within this danger zone are extinguished and dwellers are asked to leave during the period of completion.

A city inspector and a representative of the fire department make an inspection of the well and its equipment before completion operations are begun. These representatives are also present during the period of completion and have the authority to stop the process at any time as a safety measure. Several fire engines are always on the scene.

All lines and connections must always be free from leaks or breaks, the depth at which lines carrying oil are buried being governed by the pressure to be carried in the pipe.

A rescue squad remains permanently at every wild well and inhalators are kept at hand to remove gas from the lungs of those working on the derrick floor, who through carelessness or accident, may be caught without a gas mask. A fire-foam company is present at every completion, their services being readily available in case of a broken line or leaky connection.

The Oklahoma City fire department takes many special precautions against the possibilities of fire in addition to those outlined in the foregoing paragraphs of this article. Fire department foam wagons answer all calls in the oil field area. Approximately 60,000 pounds of dry powder foam is stored at the central fire station for emergencies, and additional space is available for any of the foam companies desiring storage facilities at Oklahoma City. Asbestos suits and extra foam generators are kept in reserve.

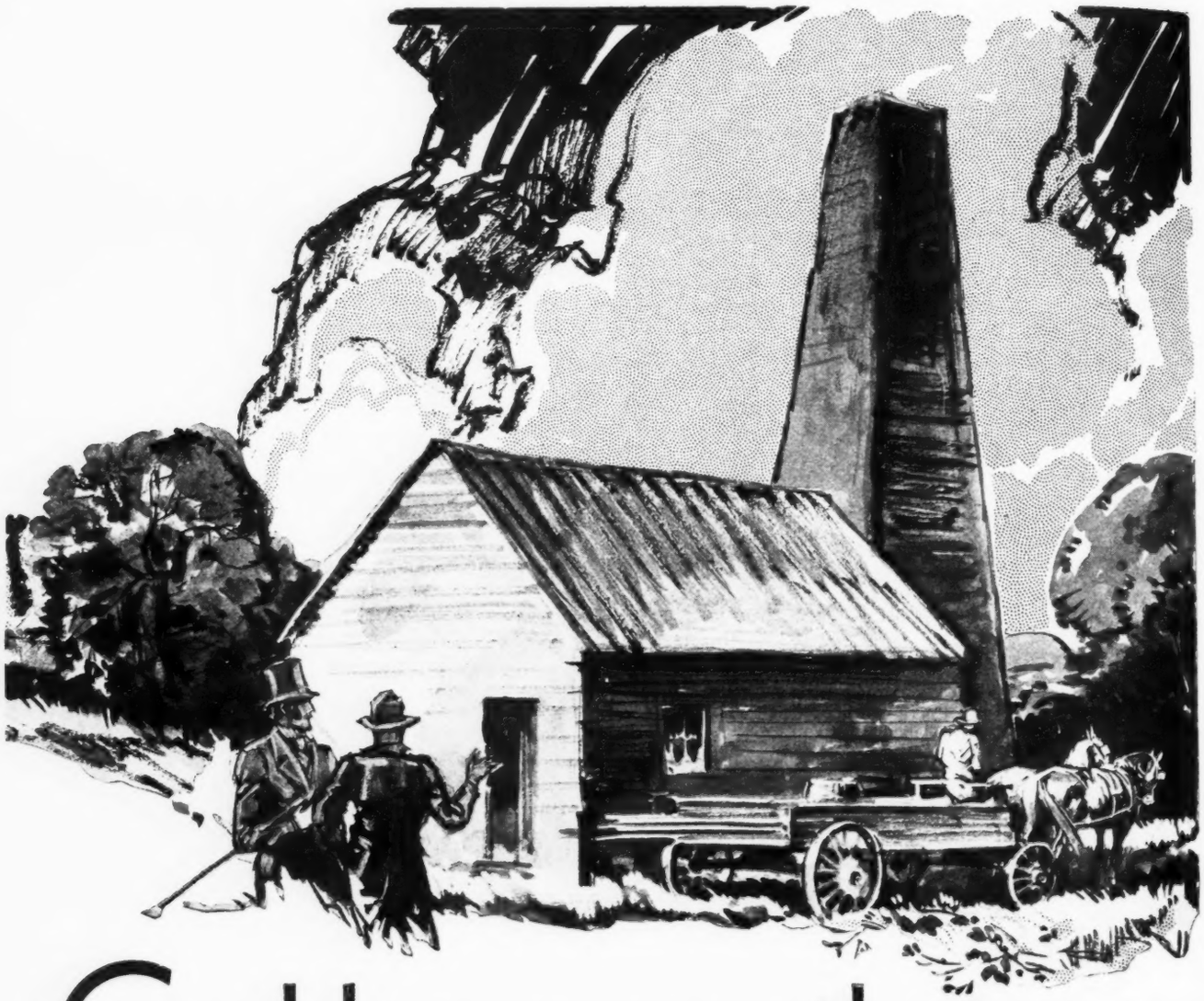
The fire department has three fire-foam trucks especially equipped for oil field work. These carry two generators, 1,600 pounds of dry foam powder, 500 feet of hose for the discharge line, four complete asbestos suits, one dozen long-handled shovels, 100 feet of rope, warning signals and flags, first aid kits, small-type fire extinguishers and a variety of small tools.

Two oil companies operating in the field have their own fire trucks and fire department. These are Indian Territory Illuminating Oil Co. and Sinclair Oil & Gas Co., the latter having recently purchased its fire truck. Their equipment is standard and designed especially for oil field service.

The Oklahoma City fire department requires that each battery of tanks be equipped with a combination chemical and steam line for extinguishing fires. An individual line entering the tank from the header must be controlled by a dual valve arrangement so that steam or foam chemical can be used on as many of the tanks as necessary. A boiler with steam up must be placed at each tank battery, both as a precaution and for operation of the steam pumps.

A permanent hook-up of a foam generating device of a capacity of not less than 1,000 gallons per minute is installed at the tank battery. It is also required that a quantity of dry foam powder, one pound for each square foot of tank surface, be housed with the generating device. Houses for storing the powder and generating device are of semi-fireproof construction and are placed as close to the tanks as conditions will warrant.

Hose connection must be made to the fire department water system and, in addition, an adequate water supply from another source must also be available.



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Under the terrific strain of present-day drilling requirements, Drake's Derrick would tumble like a house of cards. But many of his basic principles still prevail, and are at work throughout the oil fields of the world. From Drake's crude beginnings have come new towers of strength, marvels of convenience, safety, adaptability and durability.

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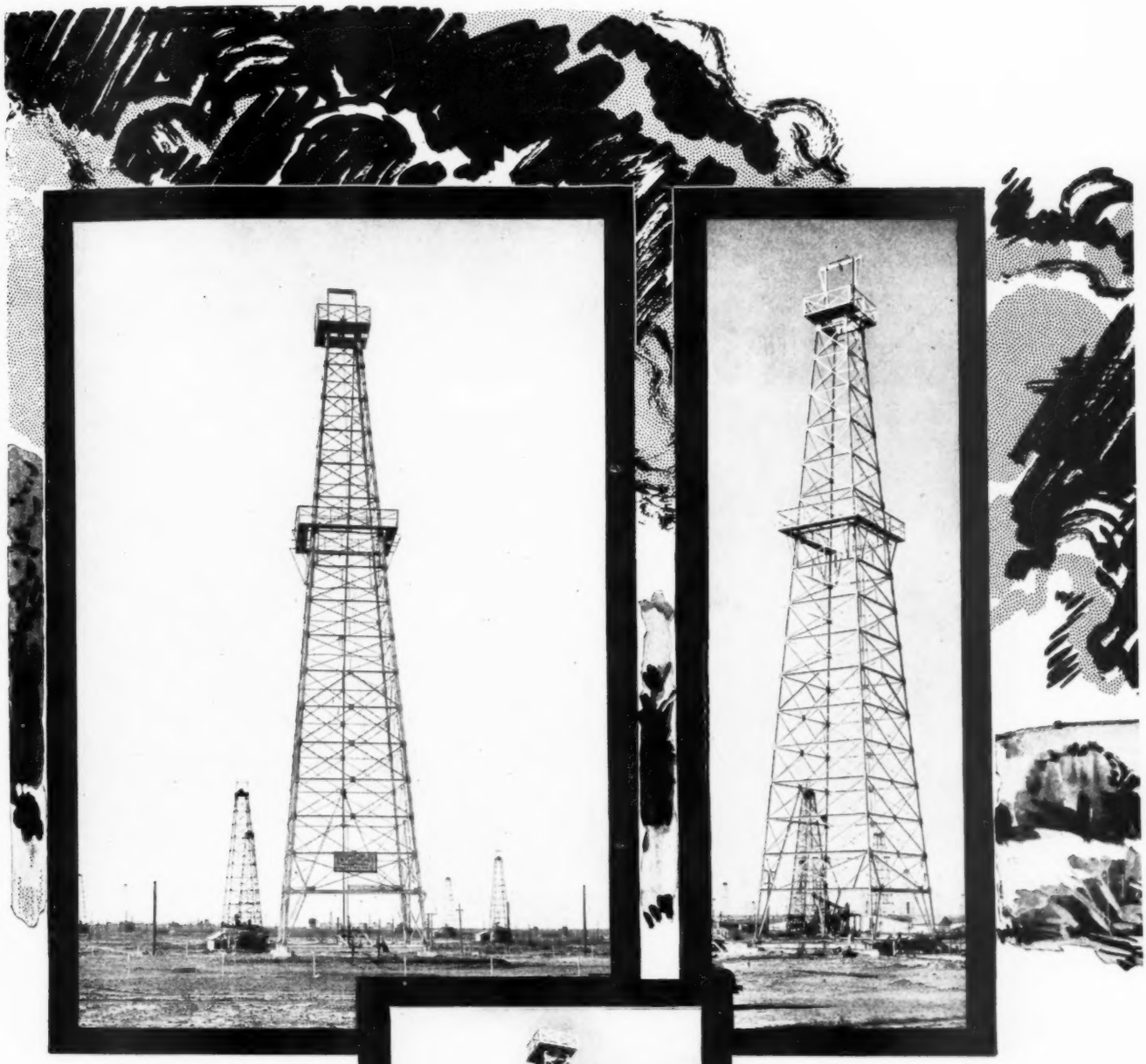

Moore Champion 122 foot Derrick, Santa Rita Well No. 2 of the Big Lake Oil Co. This well, 8603 feet deep, is one of nine wells in Big Lake Field all below 8500 feet. These nine Moore Derricks have drilled the world's deepest producers.

The University B-3 Well of the Group No. 1 Oil Company drilled to a depth of 8649 feet by this Moore 122 foot Champion Derrick.

Test well of the Stanolind Oil Company being drilled by a 94 foot Moore Champion Derrick and type No. 90 Moore Samson Post and Jack Post. This illustration also shows Moore D-W Walking Beam, type No. 30 Pitman and OCS chain-driven Sand Reel. Present plans are to drill to a depth of 8000 feet, unless production is secured at a lesser depth.

Moore Champion DERRICK

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Sucker Rods . . . Modern

SUCKER RODS play an important role in well pumping operations and influence pumping costs more than any other single item of equipment, hence they have been the subject of intensive study and investigation by oil companies.

Following their recent engineering investigation of sucker rods, this is the first of a series of articles by Mr. Wescott and his associates on the subject. This series, as a whole, will constitute one of the most comprehensive treatises that has ever appeared on sucker rods, covering, as it does, all phases from their manufacture to the latest research development.

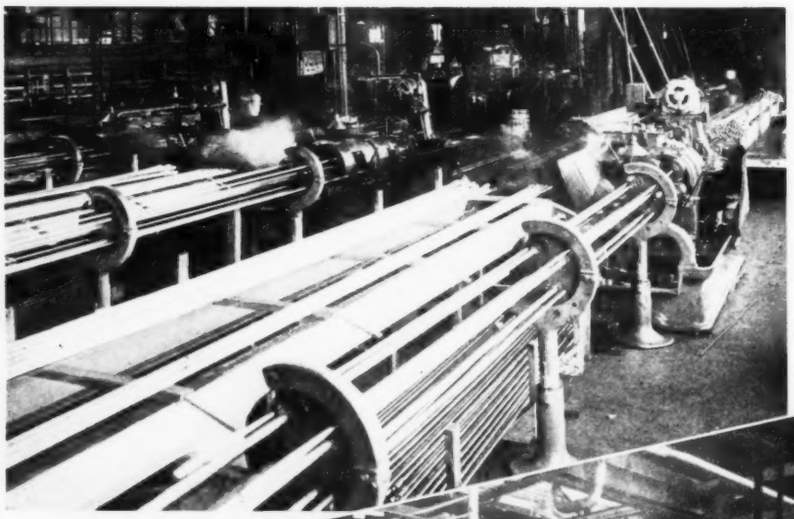


Fig. 1

Above—Automatic screw thread machine for threading sucker rods.

THE production departments of many oil companies have been seriously engaged for several years in the assembly and analysis of comprehensive data regarding the causes of shut-downs on pumping wells. Many of them have developed detailed reports that allow segregation of well troubles into the various items of equipment, and using this information as a guide, have found it possible to decrease materially the shut-down time by giving increased attention to the units principally responsible. This classified information has not only brought about more economical methods of production, but has been largely instrumental in directing the efforts of both users and manufacturers toward the development of more serviceable equipment. The analysis of well troubles of a large oil company operating in Mid-Continent fields for 1930 is given in Table I, shown on page 83.

It is clear from this tabulation that the greatest single cause of shut-downs is sucker rods.

Because the importance of decreasing the frequency of sucker rod failures is now quite generally recognized, the present and subsequent articles in this series will consider in some detail the recent developments in methods of manufacture and the field handling of sucker rods.

Forging of Upset Sucker Rods

The majority of present-day sucker rods are fabricated by forging or upsetting the ends of bar stock into boxes or pins and the methods used by the various manufacturers are essentially the same although they may differ in details. With but a single exception, none of the companies engaged in the production of sucker rods produce their own steel. Rods of the required diameter and cut to lengths are heated to a forging temperature in oil or gas-fired furnaces for a distance of about eighteen inches from their ends. In a series of successive operations, the ends are upset into either boxes or pins in heading machines which compress the hot metal in forming dies. Pins can be formed completely with only one heating, but it is sometimes necessary to reheat the partially forged boxes to complete the up-

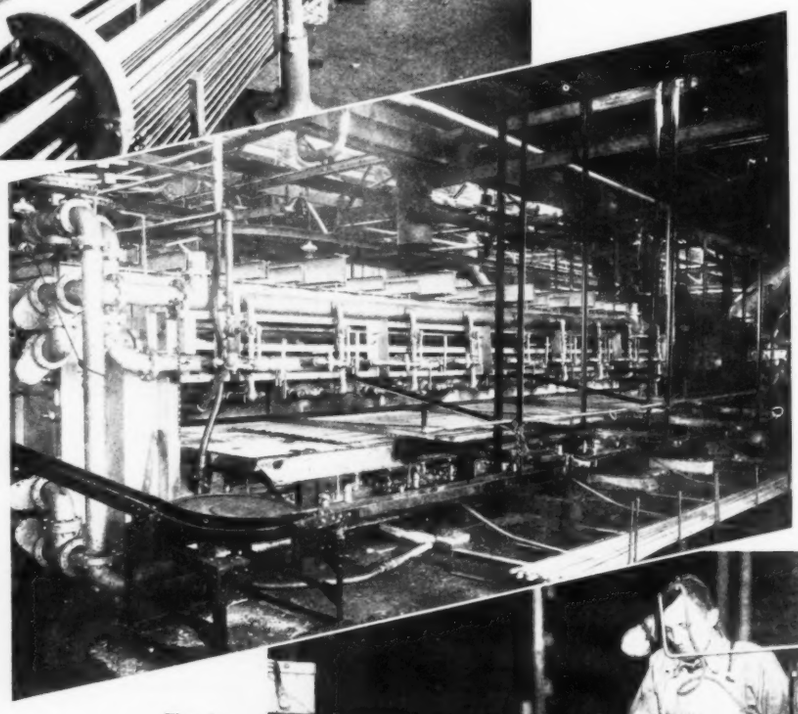
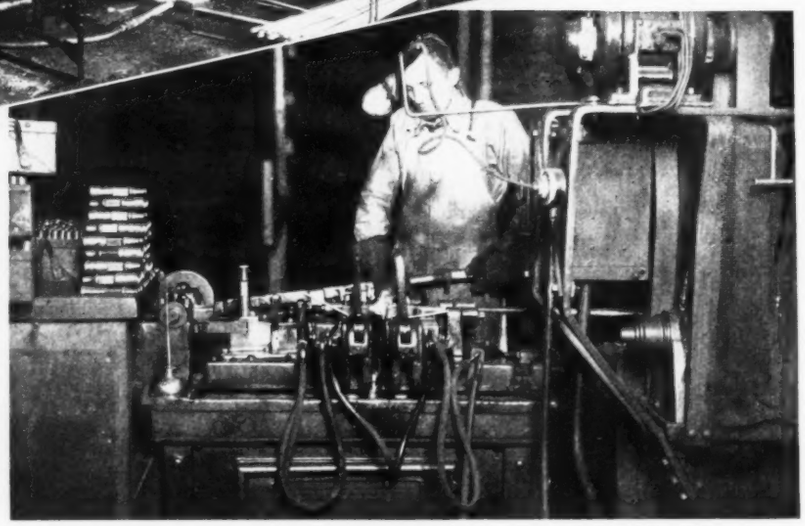


Fig. 2



Left—Discharging side of the normalizing furnace. Below — Electrical butt-welding machine for manufacturing sucker rods.

Fig. 3

Methods *of* Manufacture

Article I

By BLAINE B. WESCOTT,

Engineer of Tests, Research Laboratory of the Gulf Producing and Pipe Line Companies . . . .

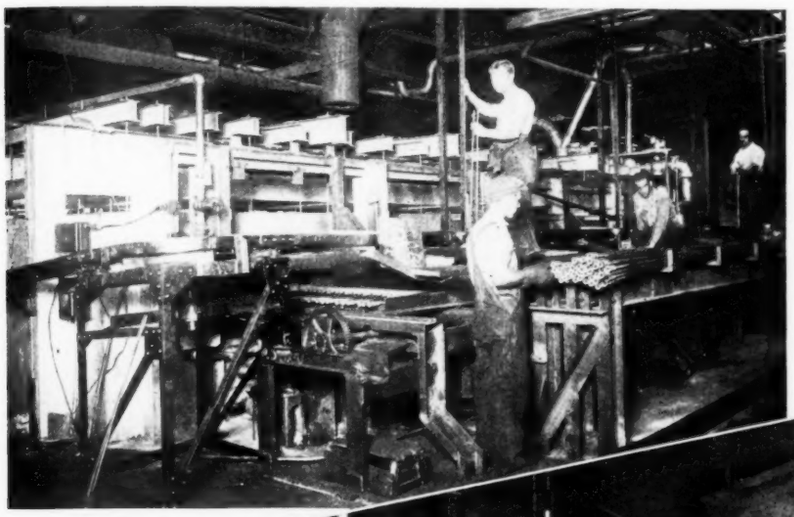


Fig. 4

Above—The charging side of a furnace used to heat normalize sucker rods completely from end to end.

setting. Reference to Figures 12 and 13 will provide a comprehensive description of the methods used to shape boxes and pins respectively; a heading machine is shown in Figure 5. Much of the quality of the finished product depends upon the manner in which the forging is carried out, as it is important that the metal be compressed into the forming dies in a uniform manner, at the proper temperature to insure complete plasticity, in order to avoid folding, seams and cold shuts which might subsequently cause premature failure in service.

Fig. 5

Removal of Forging Strains

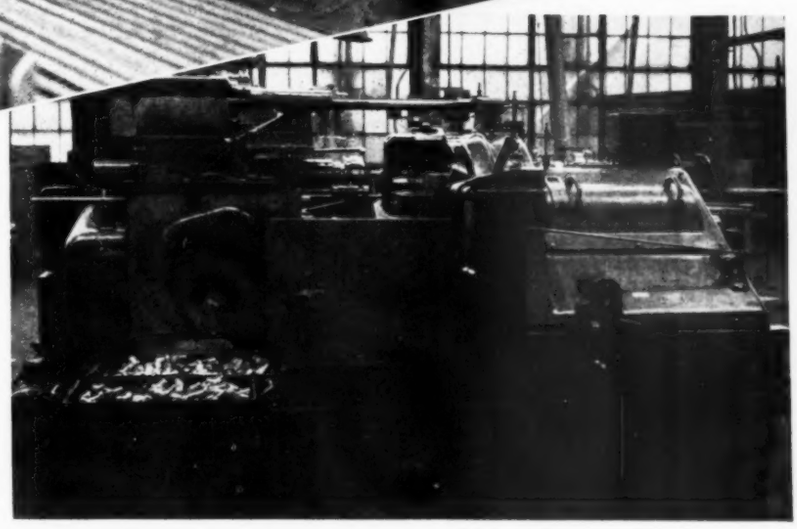
The deformation of metal cannot be accomplished without inducing internal strains and, when the operations are carried out at elevated temperatures, there is a resultant coarsening or enlargement of the crystalline grains. The next step has for its purpose the removal of forging strains and the restoration of the original structure of the metal. It is brought about by heating the forged ends to a red heat and allowing them to cool in air, thereby effecting a complete recrystallization of the metal into a fine-grained and unstressed condition. The substitution of a partial oil quench for air cooling is used by two manufacturers to impart greater strength to the joints.

A recent development has eliminated the sub-normal zones by normalizing the sucker rods throughout their entire length. This treatment produces rods of practically uniform unit strength at all points. The charging side of a full length normalizing furnace is shown in Figure 4 and the discharging side in Figure 2. The furnace is gas fired and the temperature is automatically maintained within narrow limits by electric pyrometers operating the control valves. It is of the continuous type and the rate of travel of the sucker rods through the furnace can be varied at will to suit the size of rods being treated. The perfection of complete normalizing represents an important advancement in itself, but probably its greatest significance is gained from the knowledge that it has demonstrated the feasibility of

Left — An upsetting or heading machine for sucker rod joints.

Below — Automatic machine especially designed for threading drop forged pins.

Fig. 6



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manufacturing fully heat-treated sucker rods.

Threading

Formerly threading was just one of the several steps in making sucker rods, but since the adoption of the American Petroleum Institute specifications it has become the most important operation. It is only by the use of the most modern equipment, and the finest grade of taps, dies and chasers that manufacturers can hope to meet the rigid requirements demanded of them by the purchasers. Just what success has been attained will be the subject of the next article.

Blaine B. Wescott

In several plants automatic threading machines are utilized with high efficiency and accuracy. For the most part, however, they are not provided with lead screws. Ordinarily ground thread taps are employed for threading the boxes while cut chasers are used for threading the pins. The threading floor of an entirely modernized sucker rod plant is shown in part in Figure 1. In the foreground can be seen a battery of automatic threading machines which were designed especially for sucker rods. In these machines the rods are chucked on the wrench squares to insure perfect alignment of the boxes and pins with the body of the rods. The adoption of higher strength and tougher steels for rods for deep well service has increased the difficulty of threading greatly and the future advancement in the use of steels with greater endurance resistance will be mainly dependent upon their susceptibility to economical threading.

Drop Forged Joints

Electrical resistance welding forms the basis of the other method of fabrication, whereby the boxes and pins are drop forged from round bar stock in one operation. A forging hammer for this purpose is pictured in Figure 9 and the trimming press for cutting the fins from the forgings is illustrated in Figure 8.

Heat Treatment and Threading of Forgings

The trimmed blank box and pin forgings are given a very complete heat treatment to relieve forging strains and refine the crystalline structure of the steel. The former is accomplished by normalizing from a temperature that is dependent on the type of steel. After normalizing, the blanks are oil quenched and drawn to generate the physical properties desired. The heating for both normalizing and heat treating is carried out in gas-fired furnaces equipped with electric pyrometers for temperature control. The forgings are placed on end in trays of heat resistant steel in such a manner that they are not in contact with each other, thus insuring uniform heating of each individual piece. Figure 7 shows the furnaces, quenching tanks and loading trays used for the heat treatment of forged sucker rod joints. Control and inspection of the forgings are maintained by Brinell hardness tests made on one of every ten ends treated.

After heat treatment the blanks are sand blasted to remove the scale preparatory to the threading, which is done in an auto-

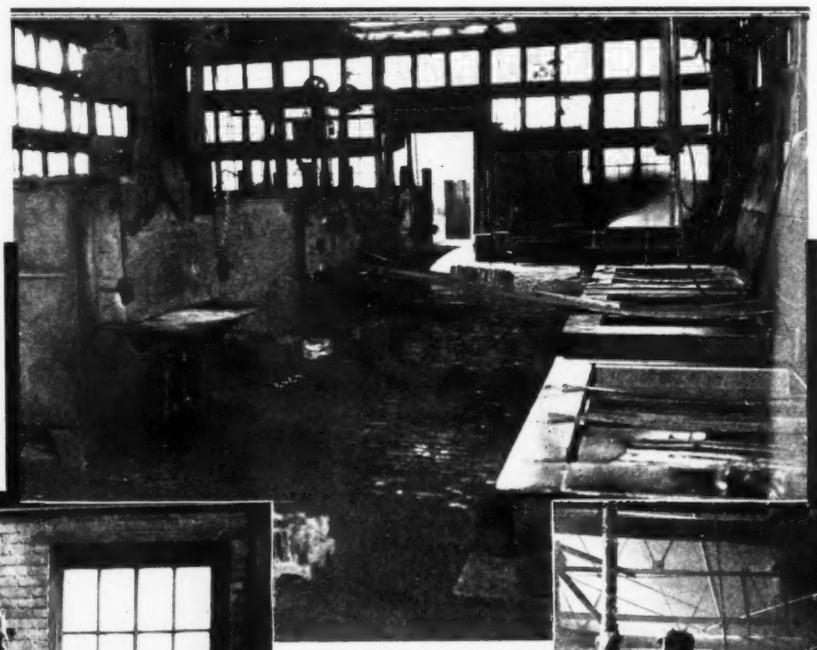

Fig. 7

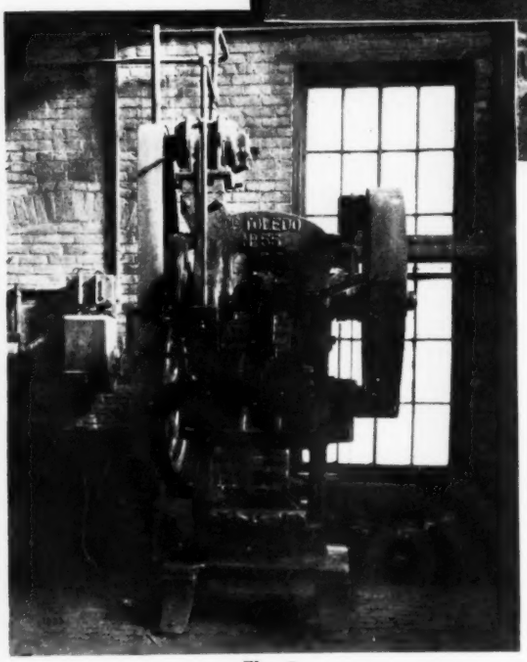

Fig. 8

Above—Heat treating department for drop forged sucker rod joints.

Left—Press for trimming fins from drop forged sucker rod ends.

Right — Hammer for drop forging sucker rod boxes and pins.

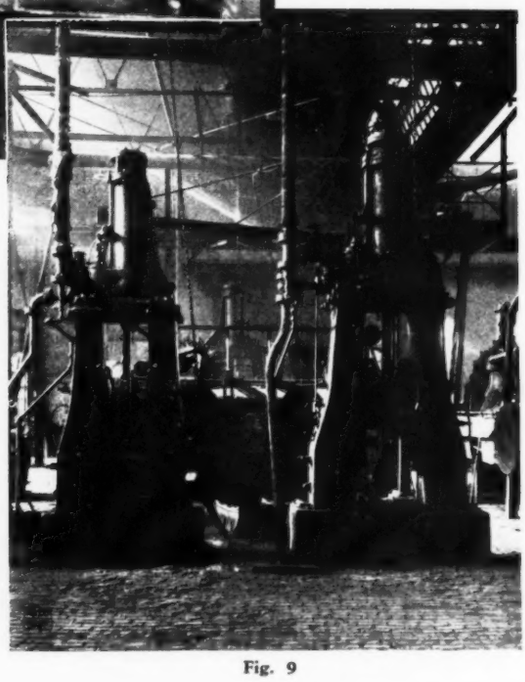

Fig. 9

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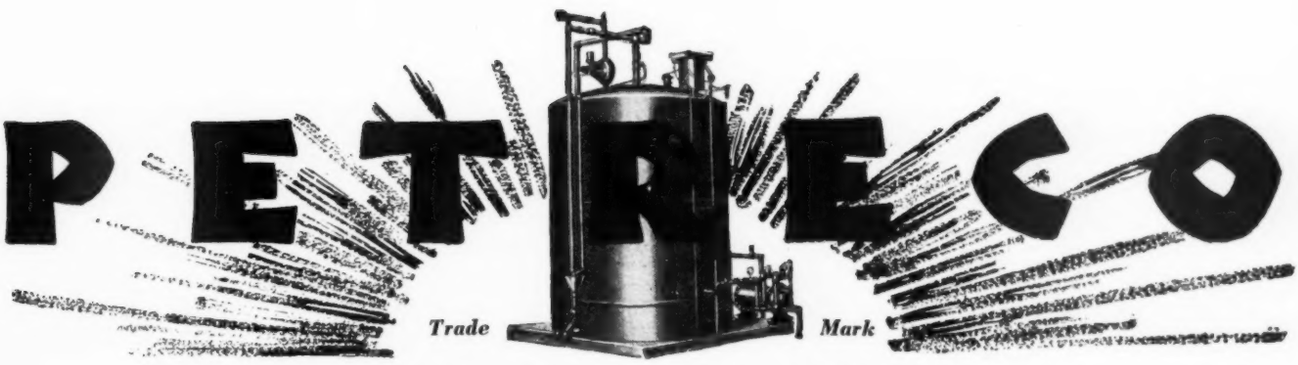

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matic machine equipped with a lead screw, the operation being much more conveniently carried out on the short pieces than on full length upset sucker rods. Figure 6 shows the machine used for threading pins and the various steps just described are shown in sequence in Figure 12.

Upsetting and Welding

It is necessary to upset the ends of the rod bodies slightly before welding in order to make the diameters of both pieces alike and to form a fillet between the forged ends and the bodies. Upsetting is done at relatively low temperatures, in two steps, with only moderate displacement of metal and in such a manner that a long and very gradual fillet results. Preparatory to welding, the ends are faced off so that the surface at the center projects slightly beyond that at the circumference of the rods; the forged ends are likewise faced off in the same manner.

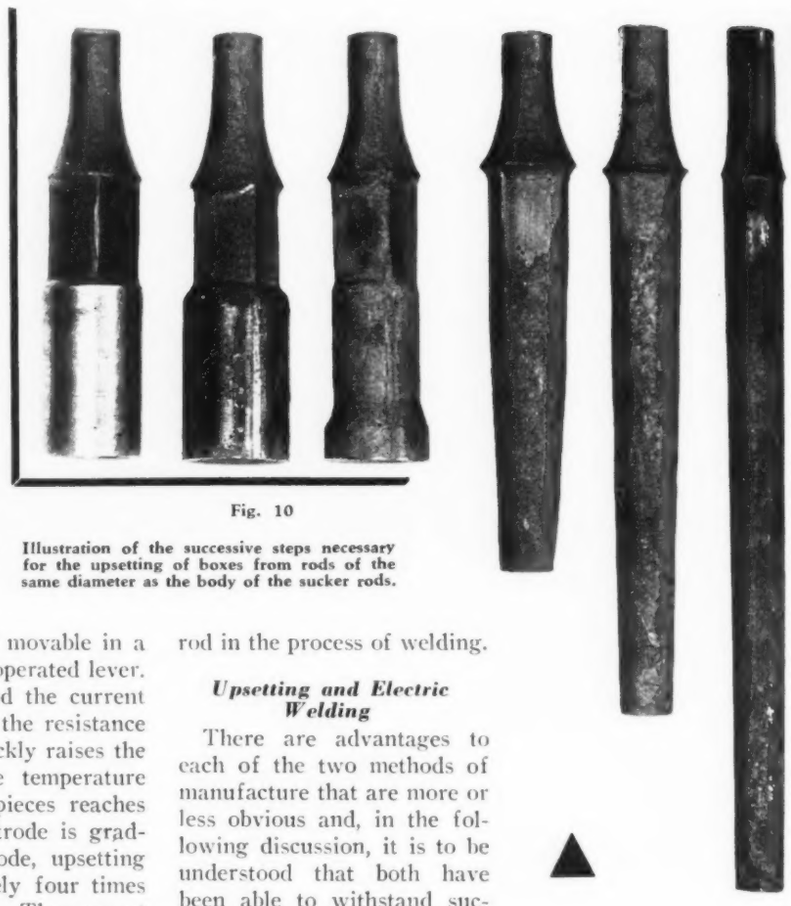

Fig. 10

Illustration of the successive steps necessary for the upsetting of boxes from rods of the same diameter as the body of the sucker rods.

The rod is gripped in a stationary electrode of the electric butt welding machine while the joint end is gripped in an electrode movable in a horizontal direction and controlled by a hand operated lever. The two centers are brought into contact and the current turned on by the depression of a foot pedal; the resistance of the metal to the passage of the current quickly raises the temperature to the welding point. As the temperature throughout the whole cross sections of the pieces reaches that necessary for welding, the movable electrode is gradually brought closer to the stationary electrode, upsetting the weld into a shoulder having approximately four times the cross sectional area of the body of the rod. The current is then turned off, the rod removed from the machine and the outer surface of the weld ground smooth. Each weld must withstand several hammer blows as an inspection test.

The method is carried out so as to insure complete welding, starting first at the center and progressively advancing to the outer edges. The large upset provides ample strength and factor of safety, and since the zones of heating do not extend beyond the electrodes, which are water cooled, there is very little change in the structure of the metal beyond the weld. The successive steps in upsetting the rods and welding are outlined in Figure 13; Figure 3 shows a rod in the process of welding.

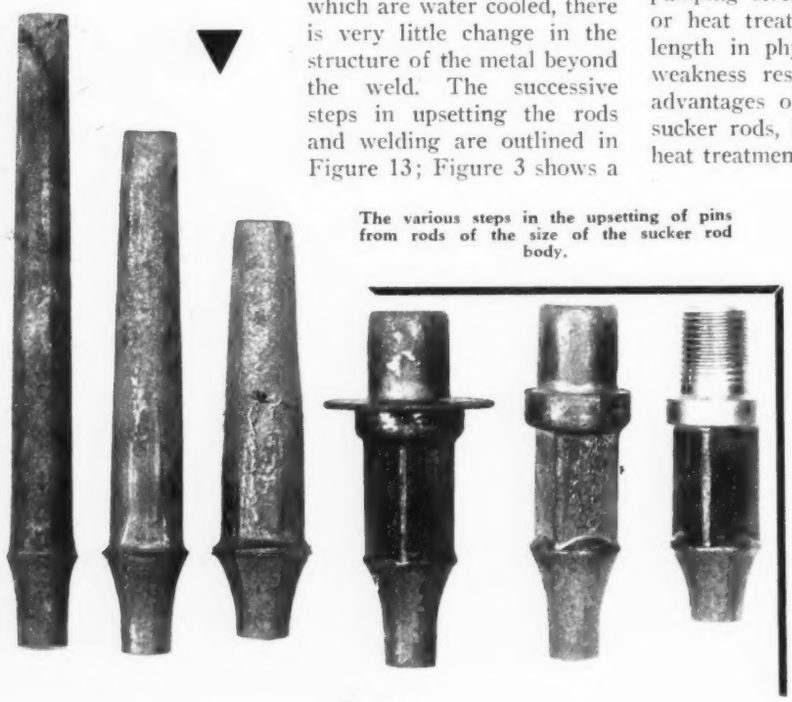

Fig. 11

The various steps in the upsetting of pins from rods of the size of the sucker rod body.

Upsetting and Electric Welding

There are advantages to each of the two methods of manufacture that are more or less obvious and, in the following discussion, it is to be understood that both have been able to withstand successfully the test of service under the most severe pumping conditions. Upset sucker rods can be made much more economically than welded rods and insure perfect alignment between the joints and bodies of the rods. Misalignment introduces unnecessarily high stresses in the joints and contributes to the frequency of pin failures. They are also shorter from fillet to fillet and the shorter joints are better suited to withstand vibratory pumping stresses. If the upset rods are fully normalized or heat treated they are uniform throughout their entire length in physical properties with no inherent points of weakness resulting from disturbed grain structure. The advantages of this condition are not present in all upset sucker rods, however, and the benefits of other incomplete heat treatments are partially offset by positional inequalities in physical properties.

The greatest advantage of the welded method is the great flexibility allowable in the product. It is possible to construct rods with one type of steel in the body and another type in the joint. Box and pin rods with case hardened or nitrided boxes for wear resistance in crooked wells can be produced with perfect facility and, as previously pointed out, it is common practice to use forged ends which have been completely heat treated. The structural alteration in welded rods occurs at points of increased cross section and is, therefore, less objectionable than that occasioned by the heat treatment of upset rod ends. Drop forging produces joints of more uniform metal displacement than even the most perfect upsetting operation and the occasional failures in the wrench squares which are

traceable to imperfections in upsetting are practically unknown in welded rods. Oversized boxes and pins offer no production difficulties when the joints are drop forged, but it is doubtful that this deviation from standard practice will materially decrease the number of failures.

Sucker rods of satisfactory quality can be manufactured by either method and the choice is largely one of personal preference. The process used is entirely subordinate in importance to the composition of steel, the perfection of threading and the exactitude of inspection; these are the primary considerations which should determine the choice of the purchaser intent on the most economical ultimate sucker rod service.

Future Development

With the rapid extension of oil production from greater depths there is a direct challenge to the resourcefulness of the manufacturers to provide sucker rods capable of meeting the greater demands that will follow the cessation of the flowing and gas lift periods. The extent of their success in this task will determine whether the lifting cost advantage of the standard rig will be maintained or whether some other method of deep well pumping will supplant sucker rods.

The past two years have seen widespread adoption of higher strength manganese steels and the displacement of the straight medium carbon steel; the complete elimination of the latter for heavy pumping service is not far distant. Normalized or air cooled manganese steels are well suited to the immediate needs, but probably cannot be used for depths greatly exceeding five thousand feet at normal pumping speeds.

Active experimentation with fully heat treated sucker rods is occupying the attention of at least three manufacturers and there is every reason to believe that they will be able to produce them without serious warpage and at a cost commensurate with the increased quality. The use of alloy steels will follow closely after the perfection of heat treating processes since their use is only justified in the heat treated condition.

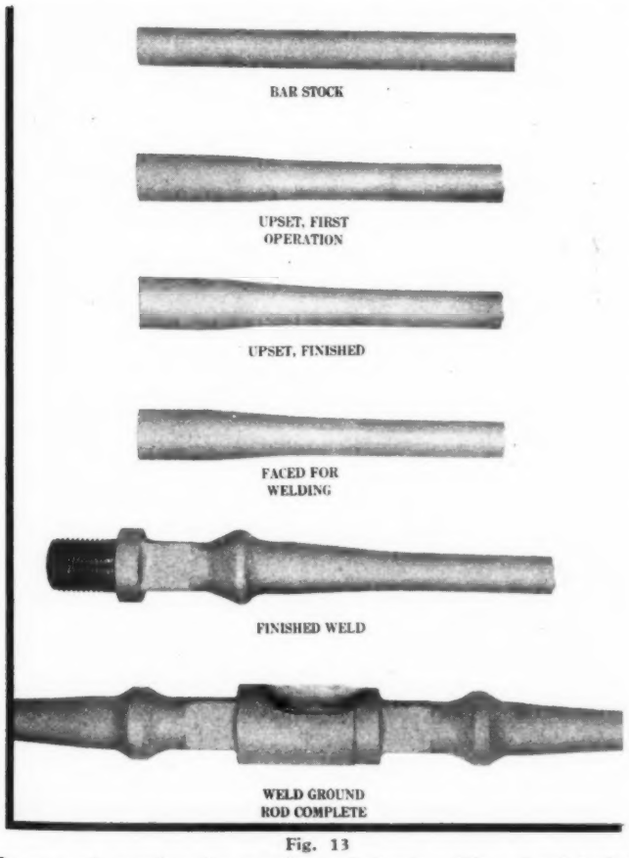

Fig. 13
Sequence of operations for upsetting and electric welding of rod bodies to the forged joints.

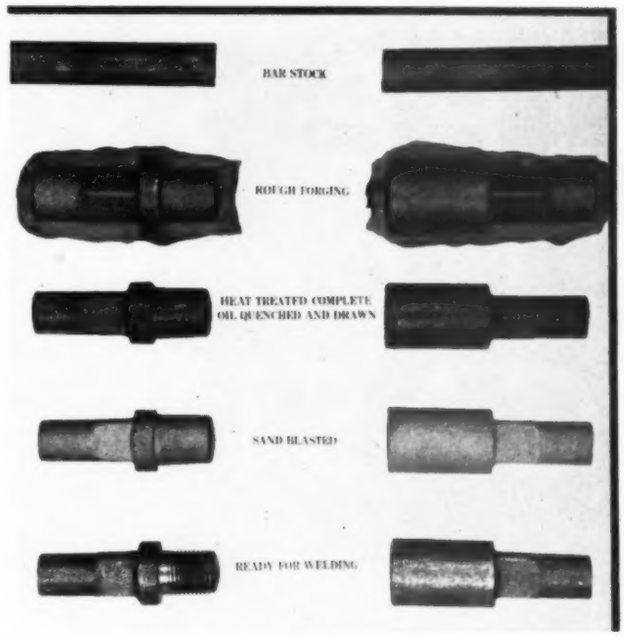

Fig. 12
Photographic description of the drop forging process used in making sucker rod joints.

The development of protective metallic coatings for exceedingly severe corrosive conditions has always offered attractive possibilities, but the results so far have been rather disappointing. Galvanized sucker rods have been used with only indifferent success principally because the coating does not possess sufficient elasticity to withstand the strains of pumping. Lead coatings are amply ductile for the purpose, but are never free from minute pinholes and the rate of corrosion of the steel underneath is greatly increased by the contact of the two metals in the presence of such an active electrolyte as ordinary well brine. Cadmium plating has offered no advantages in the field tests that have been conducted. The perfection of impervious lead coatings would go far in the solution of the problems of corrosion fatigue and hydrogen sulfide embrittlement prevalent in many locations.

The adaptation of relatively cheap, low alloy steels for increased corrosion fatigue resistance under oil well conditions appears most hopeful of success because inherent and uniform corrosion resistance is much to be preferred to the temporary protection afforded by any mechanically applied protective coating.

Acknowledgment

The author gratefully acknowledges the assistance rendered by D. R. Dale of the S. M. Jones Company, and M. T. Archer of the National Supply Company in supplying the photographs used in this article.

TABLE 1.
Analysis of Well Troubles for 1930 in Mid-Continent Operations.

Equipment	Number of Jobs	Percent of Total Estimated Production Lost	Shut Down Time
Pump[1]	39.9	18.5	22.0
Sucker Rods	15.2	24.8	14.1
Tubing[2]	7.2	18.1	13.9
Prime Movers[3]	12.7	12.1	16.8
Rigs[4]	10.4	11.3	6.7
Miscellaneous	14.6	15.2	26.5

[1] Includes standing and travelling valves, cups and working barrels.
[2] Includes sanded, paraffined, corroded and broken tubing.
[3] Gas engines, electric motors, gasoline engines and clutches.
[4] Belts, counterbalances, rig fronts, reduction gear units, etc.

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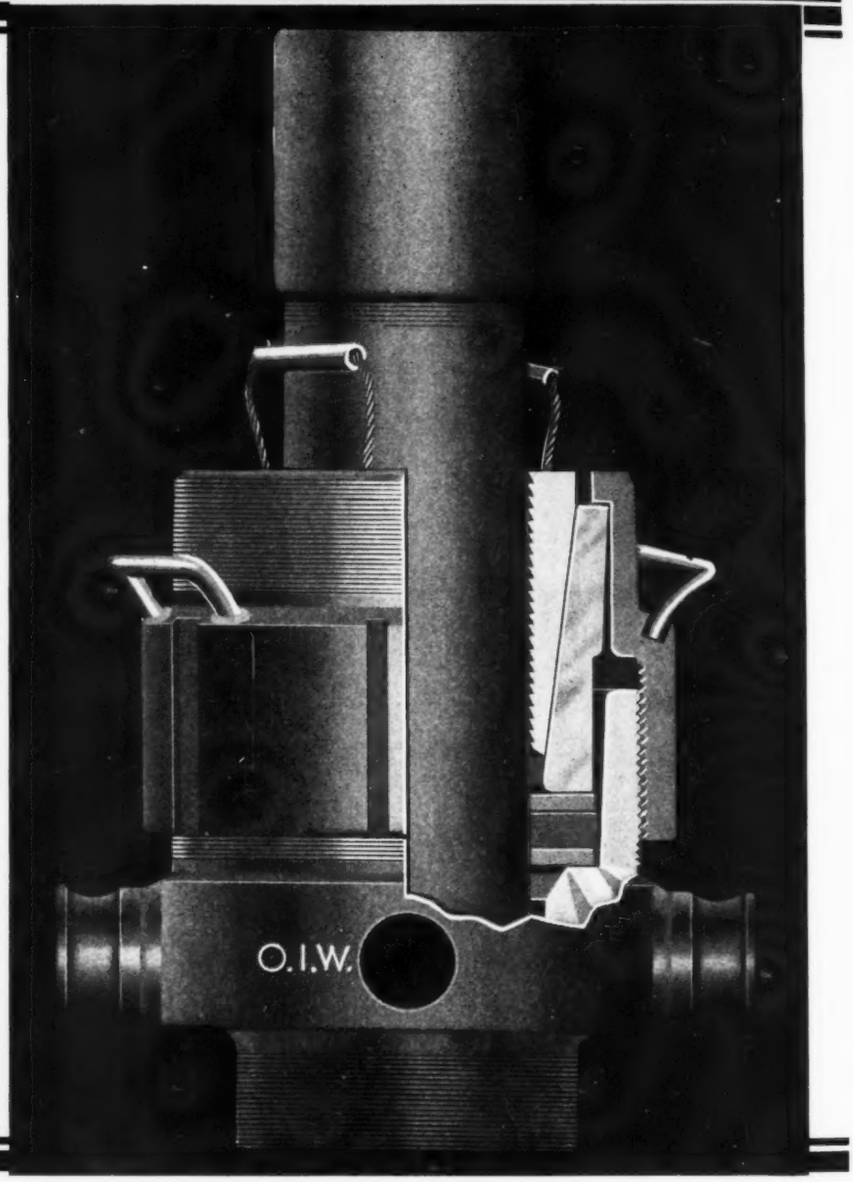

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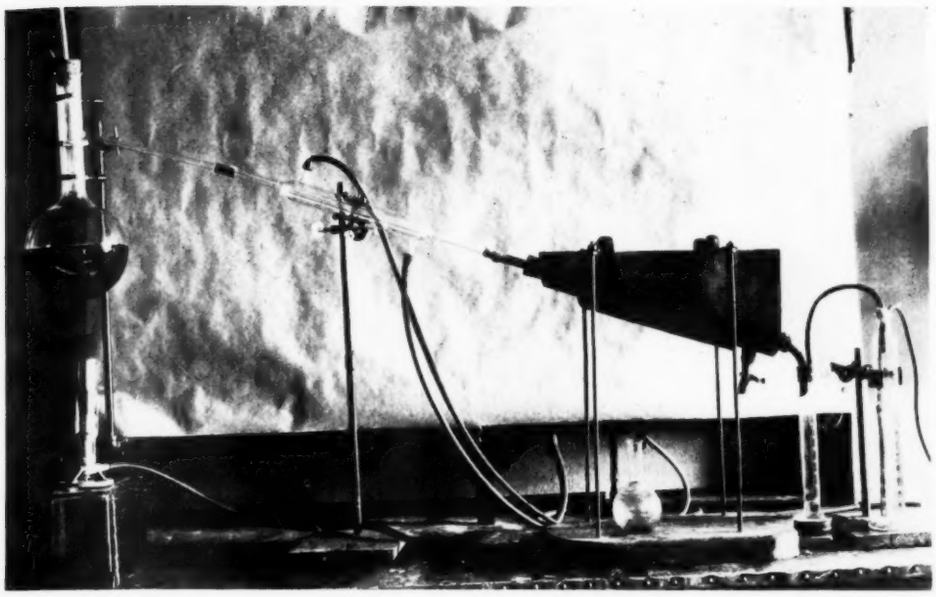


Distillation apparatus embodying two condensers for distilling gasoline content of activated charcoal.

Quick Method *of* Obtaining Gasoline Content *of* Casinghead Gas

By FRANK B. TAYLOR*

ALL petroleum development on state or patented lands in Wyoming is under the supervision of the State Geological Department. Sections 16 and 36 of each township, besides other scattered sections, are owned by the state, giving it considerable territory in its own right. To enable the State Geologist properly to supervise such development, he was authorized to appoint experienced men as State Oil and Gas Inspectors. These men are delegated authority to act for the State Geologist and to supervise field work on state or patented lands.

Several rather new field methods of inspection have been devised. For instance, in ascertaining the gasoline content of natural gas, the method employed, while it embodies well-known principles, is unique in the application and ease of making field determinations. Too often much unnecessary refinement is striven for, such that, after long and tedious work, usually complicated and expensive, results of the hair-splitting variety are produced and the commercial object of the test entirely forgotten.

Such procedure may be warranted in some cases, but usually many tests sufficiently accurate for commercial purposes can be made without resorting to a tedious and expensive method.

A quick method, together with the necessary equipment, that will be found sufficient for everyday use for ascertaining the gasoline content of casinghead gas is here described, though it is not so accurate as some laboratory methods for such determinations.

* Chief State Oil and Gas Inspector, Wyoming.

When a mixture of gases or vapors is passed through a column of activated charcoal, adsorption occurs. The gases or vapors of higher critical temperature usually are held more securely than, and displace those of lower critical temperature. This selective adsorptive property possessed by activated charcoal is made use of in testing natural gas for its gasoline content. In this short method, some gas from the well or line is passed through an orifice meter, thence through a column of activated charcoal, where the gasoline content is adsorbed. The charcoal chamber is then sealed and taken to a laboratory where its contents are transferred to a distillation flask. The gasoline content is then removed by distillation, condensed and measured.

It is important as a first step to obtain an accurate measurement of the gas sample from which the gasoline content is removed. Casinghead gas, being a mixture of several hydrocarbons, requires that the temperature, altitude, pressure, flow velocity and other factors must be taken into consideration to compute the volume accurately.

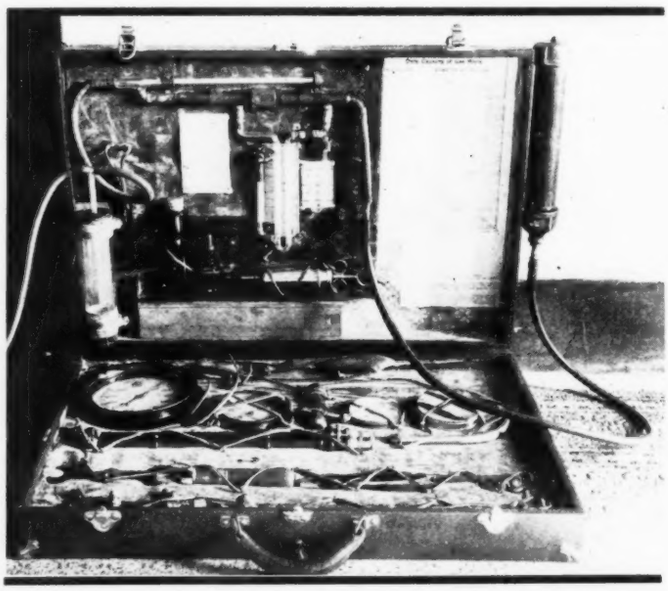
By use of the portable orifice meter illustrated, most of the required data for accurate measurement of the gas are obtainable. In taking a sample the rubber tubing on the left of the case is connected to the gas supply and forms the gas inlet to the meter.

The gas passes through a glass T tube, the lower end of which is submerged in a second and larger glass tube containing distilled water. This acts as a regulator, as any increase in pressure will cause some of the gas to force its way out of the T tube through the water. Pressure regulation is secured by moving the T tube up or down in the water.

After passing through the T tube the gas comes in contact with the bulb of a thermometer and thus the temperature of the gas is obtained.

After passing the thermometer the gas goes through the orifice meter, which, in this apparatus, has a small platinum plate orifice with a U tube connection on each side of the orifice plate. The U tube has a side outlet for filling and removing the water that measures the flow. A second U tube is connected to the orifice meter on the down-stream side to provide a mercury seal and a check on the water U tube. Passing from the meter, the gas enters the charcoal tube (made of steel pipe) thence escapes to the atmosphere through the vent in the top of the tube.

In the illustration, the meter is shown with charcoal tube in position and ready for a test run, the two bottles contain water and mercury for the regulator and U tubes. To the right of the bottles is a syringe for filling and emptying the U tubes. The scales of the U tubes are movable and can be adjusted to the height of the liquid columns in the tubes. While the meter is in use, the side outlet of the larger U tube is sealed with a short piece of tubing and clamp.



Field case for testing gas wells as used by the Wyoming State Oil and Gas Inspector.

When making a test, the meter is first purged with gas and the regulator adjusted for the desired pressure. The two U tubes are filled with water and mercury to the level desired. Sufficient gas is passed for the temperature in the apparatus to become normal. After the input connections are tested for leaks the output tube is connected to the charcoal tube while the flow is cut out for a minute. This is done by a small stop cock. The gas is then turned on and the time caught with a stop watch. After a few tests the operator is able to gauge, within close limits, the time required to pass a sufficient amount of gas through the charcoal. The differential on the large U tube is noted, then the static gauge and the temperature are read and recorded. The temperature of the surrounding atmosphere is taken with a second thermometer.

Finally the altitude where the test is being made and the gravity of the gas are obtained. A Schilling bottle, or other suitable apparatus, is used to observe the gravity of the gas.

From these values the volume can be calculated by the following formula:

$$Q = \text{Time in minutes} \times C \sqrt{\frac{h\ (25.3 + p)}{G\ T}}$$

In which:
Q = Corrected volume — cubic feet.
C = Orifice coefficient.
h = Differential in inches of water.
p = Static pressure in inches of mercury.
G = Specific gravity of gas.
T = Absolute temperature degrees F. (Observed temperature plus 460.)

In special cases, it is a good expedient to place the charcoal tube in an ice bath as adsorption takes place much more readily when the charcoal is cold than when it is warm.

As soon as sufficient gas has passed through the unit, the flow is shut off, and the charcoal tube is sealed and taken to the laboratory for the distillation of the contained gasoline. This is done in the following manner:

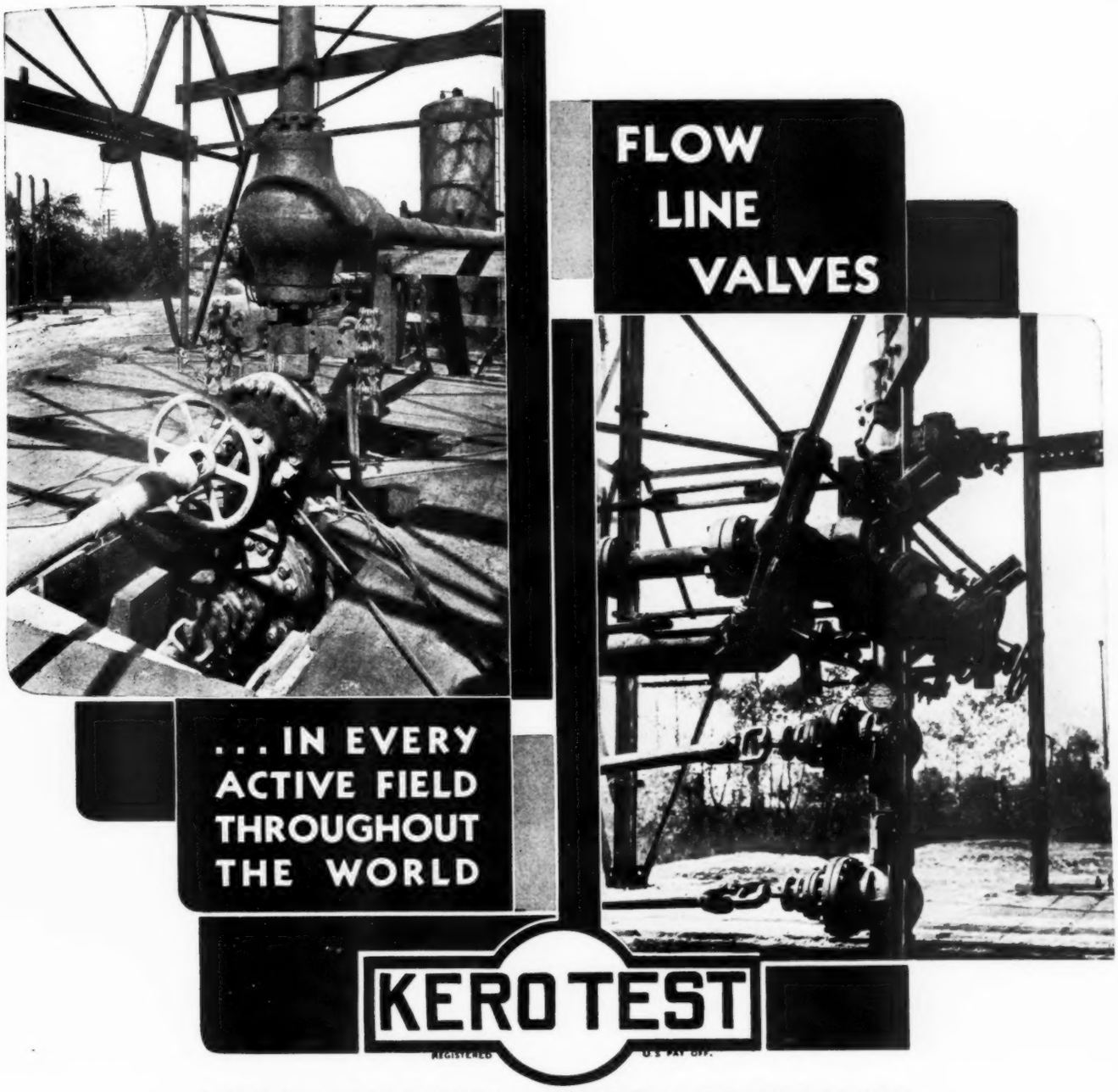
From the field container tube the charcoal is transferred to a distillation flask (about two liters capacity). Glycerine is added to assist the process and a low distillation thermometer placed in the top of flask so that the bulb is about at the opening of the tube. The flask is connected to a water-cooled glass condenser with a straight flow tube which, in turn, is connected to a metal tank condenser filled with cracked ice. This metal tank condenser delivers into a graduated receiver equipped with a rubber stopper having an outlet for vapors. This vapor outlet is connected by rubber tubing to a graduated receiver containing heavy naphtha that will absorb the lighter vapors of the distillation. An outlet tube from the naphtha absorber carries the unabsorbed vapors to the outer atmosphere.

The distillation is carried on at a temperature up to 400 degrees F. At 212 degrees the absorber flask is removed and its content noted. It is important that the distillation flask be set so that the outlet tube is at an angle of 75 degrees with the vertical tube of the flask and that this angle be maintained throughout the apparatus to the receiving graduate. A condenser having bends or turns should be avoided as the latter will retard the flow from the flask and the results will not check with those obtained from apparatus set up as shown in the illustration.

In the illustration of the distillation apparatus, the outfit is shown set up and ready for a distillation test of vapors adsorbed by charcoal. However, the absorber graduate on the extreme right is packed in ice during a run, but is shown without the ice container in order to give a better idea of the process. It is desirable to have a fire extinguisher handy.

In setting up the orifice meters and charcoal tube in the field, the case is placed on something solid and leveled with a small level. During the run, the tube must be held in a vertical position.

The field outfit is carried in a case, as shown, the lower half of which contains gauges, U tubes, tools and fittings for testing the flow of wells.



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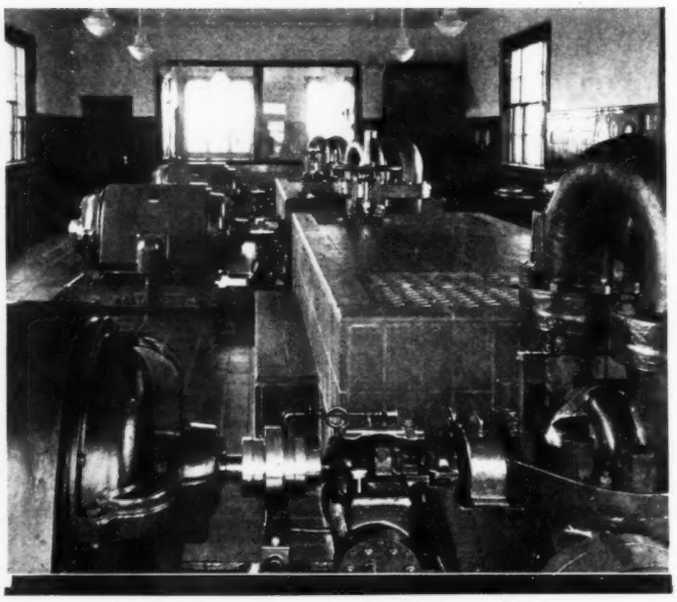
Correction Factor *for* Pipe Line Friction Losses

By JOHN M. McGREGOR*

WHILE preparing data for pipe line work, several curves, used by different pipe line companies, were examined and the wide variation in pressure drop per mile found to exist was surprising.

Table 1 shows capacities from 12-inch down to three-inch lines and pressure drop figures used by four companies. It will be seen that A and B compare very closely from 12-inch to 8-inch, inclusive, after which B pressure increases very considerably over A and virtually corresponding to C and D.

Throughout the entire range, curves C and D show much greater pressure drop than A, averaging approximately 15 per cent more. In view of these figures it would be interesting to know just how actual pumping results compare, especially considering the fact that all four companies are operating in the same fields under conditions practically similar.



Interior Van, Texas, station Pure-Van Pipe Line Co.

It will be noted that the pressure drops are based on a gravity of 10 degrees A. P. I., but, of course, the same ratio would hold good for 38 degrees A. P. I. or crudes of any other gravity.

The correction curve shown was drawn up with a view to simplifying readings and to make it possible to have in compact form capacities from 100 barrels to 3,500 barrels per hour of oil from 50 S. S. U. to 150 S. S. U. and of any gravity.

The objection has been put forward that the increase in pressure due to viscosity is not constant throughout the ranges shown. This is admitted but, on checking the correction factors against existing curves, the error would appear to be small enough to be ignored, especially when one considers the great variation in the figures used by different companies.

Although viscosities much higher than those shown on the accompanying curve are encountered, and quantities of oil greater or less than those shown for the various sized lines are pumped, it is believed the curve will serve the purpose of a handy reference in making pressure calculations.

The base curves, i. e. for 50 S. S. U., are not taken from any one company's curves, but are composite of those used by all companies under consideration. It is suggested that the correction curve, if acceptable, be used in conjunction with existing base curves for 50 S. S. U.

Examination of the correction curve will show that the increase of pressure for different viscosities is as follows:

Viscosity	Increase in Pressure
50 S.S.U. to 60 S.S.U.	9%
50 S.S.U. to 70 S.S.U.	15%
50 S.S.U. to 80 S.S.U.	21%
50 S.S.U. to 90 S.S.U.	26%
50 S.S.U. to 100 S.S.U.	30%
50 S.S.U. to 120 S.S.U.	37%
50 S.S.U. to 150 S.S.U.	45%

In addition, any intermediate point can also be found as shown in the example of the application of the curve given below.

EXAMPLE: Find pressure drop per mile when delivering 1,570 barrels per hour of 38 degrees A. P. I. oil through a 12-inch line, the oil having a viscosity of 95 S. S. U.

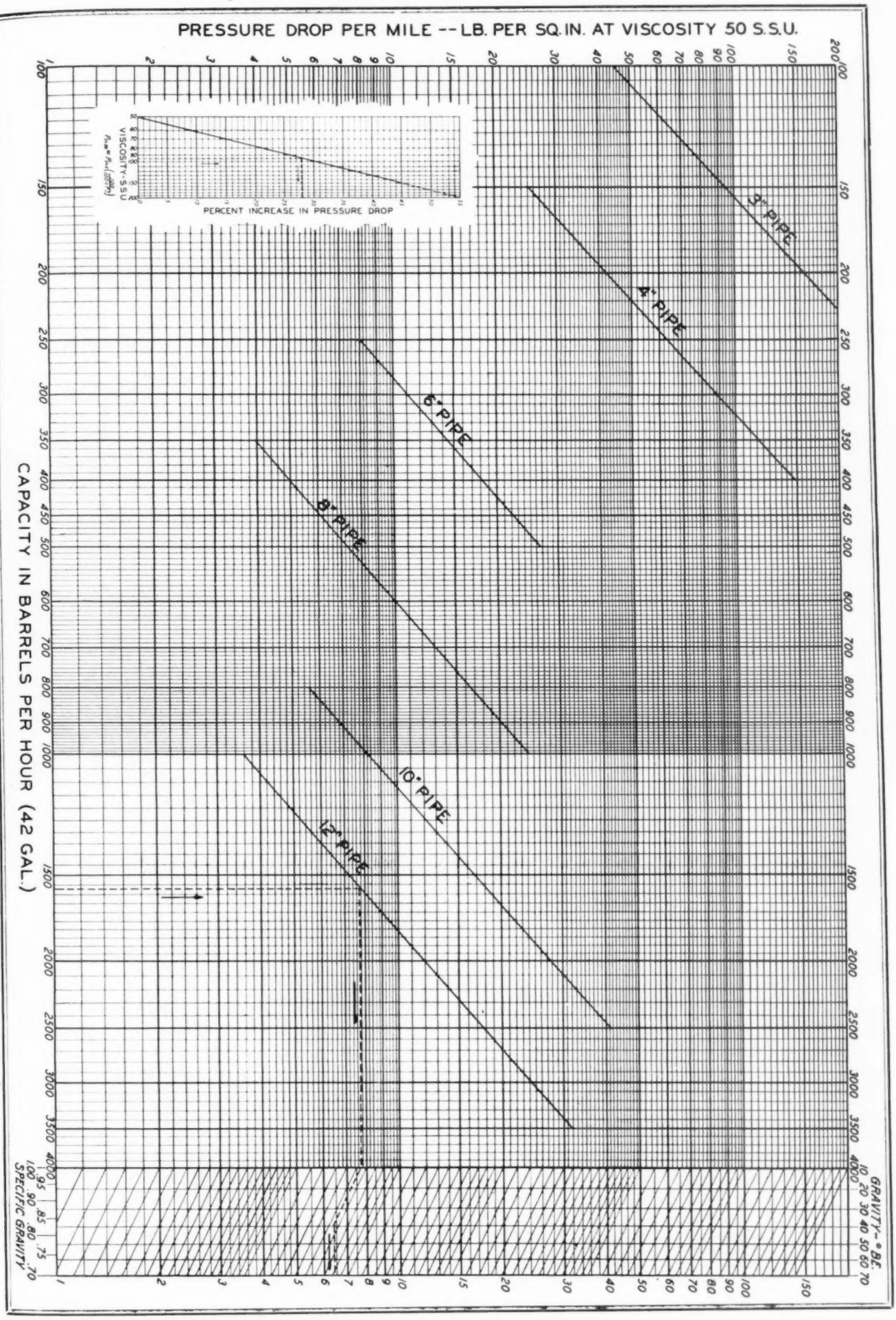
Start from 1,570 on bottom scale and follow the dotted line in the direction of the arrow. It will be found that the friction loss is 6.4 pounds per square inch. However, this is the pressure drop for oil having a viscosity of 50 S. S. U. and to find the pressure for oil of 95 S. S. U. it is necessary to look for 95 on the correction curve and follow the dotted line upward until it intersects the curve, at which point will be found the correction factor, in this instance, 27.9 per cent. To find the correct pressure loss, multiply the known pressure drop for 50 S. S. U. oil by the correction factor—6.4 x 1.279 = 8.1856 or approximately 8.19 pounds per square inch per mile.

To apply the curve further for the above example, following are the pressures corresponding to the various viscosities shown on curve:

Viscosity S. S. U.	Pressure Drop per Mile Lb. per Sq. In.
50	6.400
60	6.976
70	7.360
80	7.744
90	8.064
100	8.320
120	8.768
150	9.280

Should the pressure drop per mile be known for oil having

*Engineer, The Chapman Valve Mfg. Co.


PRESSURE DROP PER MILE -- LB. PER SQ. IN. AT VISCOSITY 50 S.S.U.
VISCOSITY - S.S.U.
PERCENT INCREASE IN PRESSURE DROP
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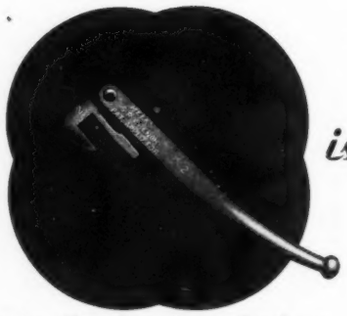


a higher viscosity than 50 S. S. U., the equation shown on the curve can be used.

$$Pv50 = Pvx \left\{ \frac{100}{100 + P.\ I.} \right\}$$

Where Pv50 = Pressure per mile for oil having a viscosity of 50 S. S. U.

Where Pvx = Known pressure per mile of oil of known viscosity from 50 S. S. U. to 150 S. S. U.

Where P.I. = Percentage increase for pressure of known

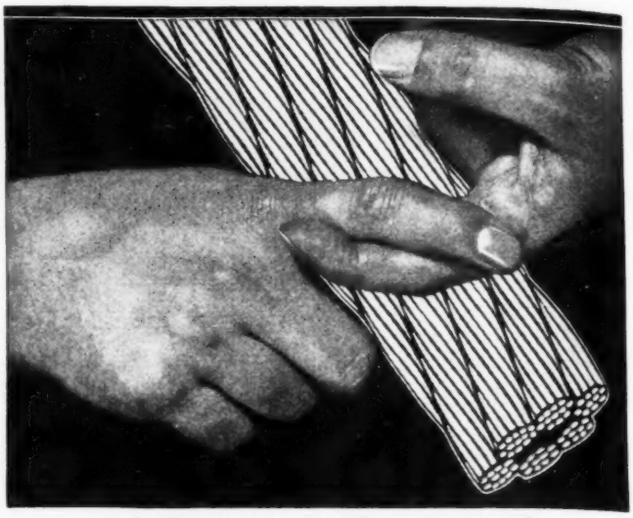
TABLE No. 1

Bbl./Hr.	Pipe Size	Pressure Drop per Mile Lb. per Sq. Inch 50 S. S. U. Gravity 10° "A"	"B"	"C"	BE "D"	Per Cent Difference "B," "C," "D," + or — "A" "B"	"C"	"D"
3000	12″	24.2	24.0	28.3	29.2	—0.83	+16.90	+20.70
2400	.....	16.2	16.4	19.0	19.5	+1.23	+17.30	+20.40
1800	.....	9.7	9.8	11.3	11.7	+1.03	+16.50	+20.60
1200	.....	4.8	4.8	5.4	5.6	=	+12.50	+16.65
2000	10″	27.7	27.6	33.0	33.7	—0.36	+19.15	+21.70
1600	.....	17.8	18.6	22.0	22.3	+4.50	+23.60	+25.30
1200	.....	11.4	11.3	13.2	13.3	—0.88	+15.80	+16.65
1000	.....	8.3	8.2	9.6	9.6	—1.21	+15.70	+15.70
1000	8″	24.2	24.2	27.5	28.4	=	+13.65	+17.35
800	.....	16.5	16.3	18.6	19.0	—1.31	+12.70	+15.15
600	.....	10.1	10.4	11.3	11.5	+2.98	+11.90	+13.85
400	.....	4.9	4.9	5.5	5.8	=	+12.25	+18.35
500	6″	26.8	30.2	31.5	30.8	+12.65	+17.55	+19.95
450	.....	22.3	25.2	26.2	25.7	+13.00	+17.55	+15.25
350	.....	14.4	16.2	17.2	16.5	+12.50	+19.45	+14.55
250	.....	8.1	9.0	9.5	9.4	+11.10	+17.30	+16.05
400	4″	127.0	147.0	148.0	146.7	+15.75	+16.55	+15.50
300	.....	76.8	88.0	90.0	88.5	+14.60	+17.20	+15.25
200	.....	38.2	42.5	44.0	44.0	+11.25	+15.20	+15.20
200	3″	137.5	157.0	175.0	160.0	+14.20	+27.25	+16.35
150	.....	83.6	94.5	105.0	97.6	+13.05	+25.60	+16.75
100	.....	41.5	45.5	51.8	48.7	+ 9.65	+24.80	+17.35

TABLE No. 2

Bbl./Hr.	Pipe Size	Pressure Drop Per Mile Lb. Per Sq. In. 10° Be = Sp. Gv. 1.00 50 S. S. U. "A"	100 S. S. U. "A"	From Curve	Percentage Difference Correction Curve + or — Curve "A"
3000	12″	24.2	30.9	31.5	+1.94
2400	.....	16.2	21.0	21.1	+0.48
1800	.....	9.7	12.7	12.6	—0.79
1200	.....	4.8	6.3	6.3	=
2000	10″	27.7	35.9	36.0	+0.28
1600	.....	17.8	23.6	23.2	—1.69
1200	.....	11.4	14.9	14.8	—0.67
1000	.....	8.3	10.8	10.8	=
1000	8″	24.2	31.7	31.5	—0.63
800	.....	16.5	21.5	21.5	=
600	.....	10.1	13.1	13.1	=
400	.....	4.9	6.4	6.4	=
500	6″	26.8	35.1	34.9	—0.57
450	.....	22.3	29.2	29.0	—0.69
350	.....	14.4	18.9	18.7	—1.06
250	.....	8.1	10.3	10.5	+1.94
400	4″	127.0	164.5	165.0	+0.32
300	.....	76.8	100.6	99.8	—0.79
200	.....	38.2	49.5	49.6	+0.20
200	3″	137.5	180.0	179.0	—0.56
150	.....	83.6	109.0	108.6	—0.37
100	.....	41.5	53.2	53.9	+1.32

HOLD YOUR HANDS LIKE THIS ▲▲



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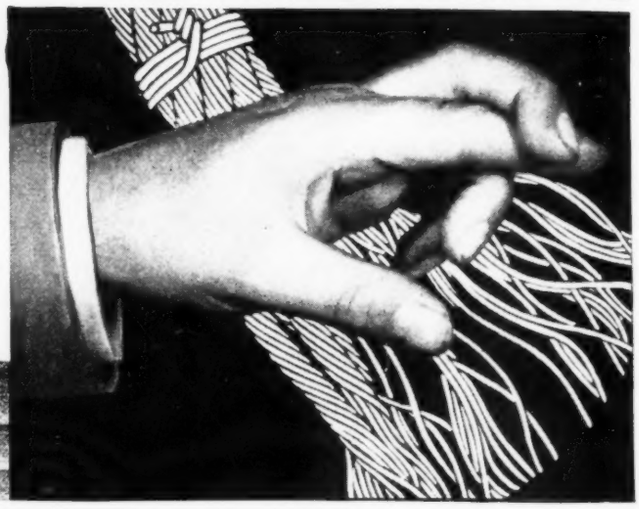

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TABLE No. 3

Bbl./Hr.	Pipe Size	Pressure Drop Per Mile Lb. Per Sq. In. 10° Be = Sp. Gr. 1.00 50 S. S. U. "B"	100 S. S. U. "B"	From Curve	Percentage Difference Correction Curve + or — Curve "B"	Pressure Drop Per Mile Lb. Per Sq. In. 10° Be = Sp. Gr. 1.00 150 S. S. U. "B"	From Curve	Percentage Difference Correction Curve + or — Curve "B"
3000	12″	24.0	30.8	31.2	+1.3	34.3	34.8	+1.5
2400	.....	16.4	20.9	21.3	+1.9	23.5	23.8	+1.3
1800	.....	9.8	12.6	12.7	+0.8	14.2	14.2	=
1200	.....	4.8	6.2	6.2	=	7.1	7.0	—1.4
2000	10″	27.6	35.4	35.9	+1.4	40.0	40.0	=
1600	.....	18.6	24.2	24.2	=	27.3	27.0	—1.1
1200	.....	11.3	14.6	14.7	+0.7	16.6	16.4	—1.2
1000	.....	8.2	10.7	10.7	=	12.1	11.9	—1.6
1000	8″	24.2	31.4	31.5	+0.3	35.7	35.2	—1.4
800	.....	16.3	21.4	21.2	—0.9	24.0	23.7	—1.3
600	.....	10.4	13.3	13.5	+1.5	15.4	15.1	—1.9
400	.....	4.9	6.4	6.4	=	7.1	7.1	=
500	6″	30.2	38.6	39.3	+1.8	43.2	43.8	+1.4
450	.....	25.2	32.3	32.8	+1.6	35.9	36.7	+1.7
350	.....	16.2	20.7	21.1	+1.9	23.2	23.5	+1.3
250	.....	9.0	11.7	11.7	=	13.0	13.0	=
400	4″	147.0	188.0	191.0	+1.6	209.0	213.0	+1.9
300	.....	88.0	112.0	114.5	+2.2	125.0	127.5	+2.0
200	.....	42.5	54.5	55.3	+1.5	61.0	61.6	+1.0
200	3″	157.0	200.0	204.0	+2.0	224.0	228.0	+1.8
150	.....	94.5	121.0	122.5	+1.2	135.0	137.0	+1.5
100	.....	45.5	58.5	59.2	+1.2	65.0	66.0	+1.5

TABLE No. 4

Bbl./Hr.	Pipe Size	Pressure Drop Per Mile Lb. Per Sq. In. 10° Be = Sp. Gv. 1.00 50 S. S. U. "D"	100 S. S. U. "D"	From Curve	Percentage Difference Correction Curve + or — "D"	Pressure Drop Per Mile Lb. Per Sq. In. 10° Be = Sp. Gv. 1.00 150 S. S. U. "D"	From Curve	Percentage Difference Correction Curve + or — "D"
3000	12″	29.2	37.4	38.0	+1.6	41.8	42.4	+1.4
2400	.....	19.5	25.0	25.4	+1.6	28.0	28.3	+1.1
1800	.....	11.7	15.0	15.2	+1.3	16.8	16.9	+0.6
1200	.....	5.6	7.3	7.3	=	8.1	8.1	=
2000	10″	33.7	42.8	43.5	+1.6	47.8	48.6	+1.7
1600	.....	22.3	28.8	29.0	+0.7	31.9	32.3	+1.3
1200	.....	13.3	17.1	17.3	+1.2	19.4	19.3	—0.5
1000	.....	9.6	12.5	12.5	=	14.0	13.9	—0.7
1000	8″	28.4	36.5	36.9	+1.1	41.3	41.2	—0.2
800	.....	19.0	25.0	24.7	—1.2	27.8	27.6	—0.7
600	.....	11.5	15.2	15.0	—1.3	16.9	16.7	—1.2
400	.....	5.8	7.4	7.5	+1.4	8.5	8.4	—1.2
500	6″	30.8	40.4	40.1	—0.7	45.4	44.7	—1.5
450	.....	25.7	33.6	33.4	—0.6	37.8	37.3	—1.3
350	.....	16.5	21.5	21.5	=	24.3	23.9	—1.6
250	.....	9.4	12.1	12.2	+0.8	13.6	13.6	=
400	4″	146.7	191.0	191.0	=	215.0	213.0	—0.9
300	.....	88.5	116.3	115.0	—1.1	129.8	128.5	—1.0
200	.....	44.0	57.4	57.3	—0.2	64.6	63.8	—1.2
200	3″	160.0	208.0	208.0	=	233.0	232.0	—0.4
150	.....	97.6	126.0	126.8	+0.6	143.0	142.0	—0.7
100	.....	48.7	62.5	63.3	+1.3	70.3	70.6	+0.4

viscosity over pressure at 50 S. S. U. as found on correction curve.

EXAMPLE: If it be known that, when pumping a certain quantity of oil having a viscosity of 100 S. S. U., the pressure per mile is 13 pounds per square inch and it be desired to know the pressure for 50 S. S. U., application of the equation would show the pressure per mile to be 9.999 pounds per square inch, or approximately 10 pounds. The

correction curve shows the percentage increase from 50 S. S. U. to 100 S. S. U. is 30.

Hence: $Pv50 = 13\left\{\frac{100}{100 + 30}\right\} = 9.999$ or 10 pounds.

Should it be necessary to know pressure at some point other than 50 S. S. U. as (for example, 70 S. S. U.) multiply by the correction factor as in the first example. In this case the increase would be 15 per cent. Consequently the pressure per mile in pounds per square inch for oil at 100 S. S. U. would be 13; at 50 S. S. U. — 10; and at 70 S. S. U. — 11.5.

Table 2 shows a comparison between the figures taken directly from the curves of company A for 50 S. S. U. and 100 S. S. U. (Those for 150 S. S. U. were not obtainable) and the result secured by using the correction factor of 30 per cent.

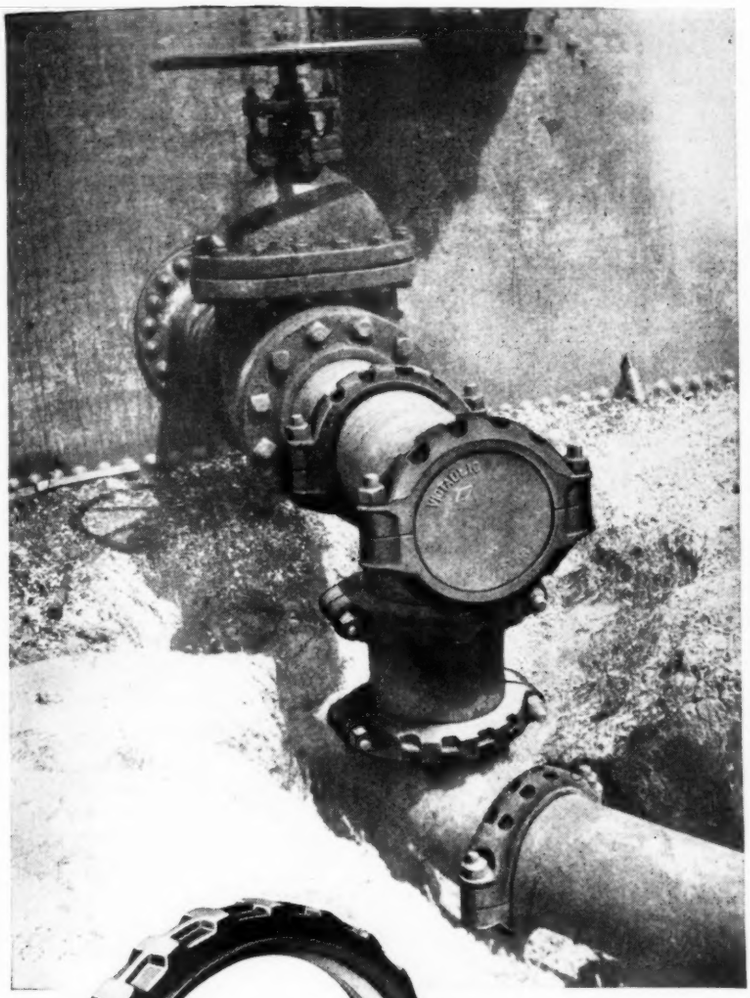
Table 3 also gives an idea of how close the readings from the correction curve are to those taken directly off the curves, in this case those of company B. The third column shows the pressure drop per mile at 50 S. S. U. taken from B curve, the fourth column shows the same thing, but at 100 S. S. U. and the fifth column the results using the correction factor, in this case, 30 per cent over the base curve figures for 50 S. S. U. The next column shows the percentage difference between the figures arrived at by using the correction curve and those found by reading directly from the curves of company B. The next three columns are similar to those preceding except they are for 150 S. S. U., the correction factor in this instance being 45 per cent.

THE correction curve, tables and equations included in this article were originally worked out by Mr. McGregor for his private use. Necessary data were gathered by a slow, tedious process and Mr. McGregor has manifested a spirit of unselfishness in thus giving the fruits of his research to the industry. We are especially well pleased to have the opportunity of publishing his article.— EDITOR.

Although the use of the correction curve in one or two instances gives an error of about 2 per cent it is much closer in the majority of cases and apparently even 2 per cent would not be too great, when a glance at Table 1 shows that companies are operating their lines using curves with differences greater than 20 per cent. It would be of extreme interest if some group of men, such as the A. S. M. E., made a study of the subject of pipe line friction loss and see just how the different companies arrive at their figures and to make a comparison of operating results when using figures such as those found in Table 1, as, for example, the pressure drop per mile when delivering 1,600 barrels through a 10-inch line. Companies A and B show 17.8 pounds and 18.6 pounds, respectively, and companies C and D show 22.0 pounds and 22.3 pounds, or a difference of approximately 25 per cent in the figures of C and D over that used by A.

Texas Pipe Line Co.'s junction station on the West Texas-Houston line.

"For every joint on the line"



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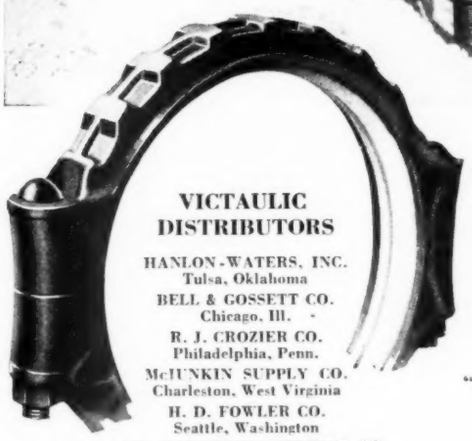

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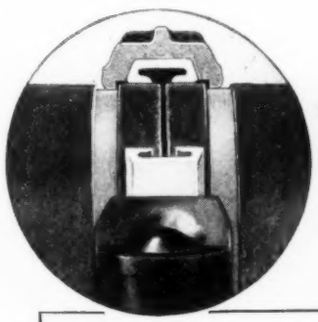

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DETERMINATION *of* An Oil Well's Potential PRODUCTION

• *By* K. C. SCLATER •

BRIEF reference was made in the first article of this series (see January issue) to the confusion that exists concerning the term potential production. Despite the fact that it now occupies a foremost place in oil field parlance, it is a grossly abused and misunderstood term, especially as applied to the production of an oil well. In recommendations recently submitted by a special committee to the California Statewide Committee on Curtailment appears the following statement: "The true measure of potential of all wells should be the amount of crude they can produce under customary conditions and methods, with the entire field in which they are located on full production in the same manner and at the same time." Potential as defined in this recommendation is subject to a wide interpretation and is intended to meet the practical conditions found in the average field, as it states under customary conditions and methods and how other wells in the field should be producing when the potential of an individual well is taken. It would be futile to discuss the practical aspects and feasibility of methods for determining a well's potential production without having clearly in mind the real purport of the term potential production itself.

THE potential production of an oil well is the maximum rate of oil flow INTO the hole, not out of the hole. Its determination, to be equitable to all producers in a pool, should be based on sub-surface conditions within the producing formation. These sub-surface conditions as encountered in actual field practice are so variable that establishing potentials for each well must take into account these variables if equitable rates of oil flow are to be established at each well.

Producing wells so as to maintain a uniform reservoir pressure in the pool by the control of bottom-hole pressures points to a practical solution of the problem of taking care of most, if not all, of these variable sub-surface conditions.

Development of the necessary instruments to obtain bottom-hole pressure measurements and give a continuous record at the surface will take the determination of an oil well's potential out of the realm of conjecture.

The potential production of an oil well is a measure of its capacity to produce oil, and since we are dealing with equities in a common reservoir containing oil, gas, and gas or some other form of potential energy, only reservoir conditions influencing the rate of flow *into* the well should be considered and other factors ignored. Reasoning thus, the potential production of a well can be defined as the maximum rate at which oil will flow *into* the hole from the producing sand without restriction other than the pressure at the face of the producing formation necessary to establish such maximum rate of oil flow.

Potential production is the maximum rate of oil flow *into* the hole, not out of the hole. The rate of oil flow out of the hole is influenced by the size and length of flow string and method of production, while the rate of flow into the hole is influenced only by reservoir conditions. The diameter of hole and penetration in the producing formation can alter the potential production, but their influence on the rate of flow into the hole can be considered a constant. So far as the individual well operator is concerned, the only means by which he can vary the rate of flow into his well is by a change in the operating pressure at the face of the producing formation or, as it is sometimes called, bottom-hole pressure.

The potential production of a well is something very definite. Once a well is completed and placed on production it is solely dependent on conditions within the producing formation. It is repeated here for emphasis that the potential production of a well, to be equitable, should have to do with the flow of oil into the hole, not out of the hole.

On the basis of conditions within and without the reservoir, all factors that influence the rate at which a well produces at the surface can be conveniently classified under two heads, namely, natural factors and artificial factors.

Natural factors include sub-surface conditions as pressure, temperature, physical character of the producing formation, its texture, thickness, porosity and saturation, character of the oil and gas and the nature of their association or mode of distribution in the reservoir.

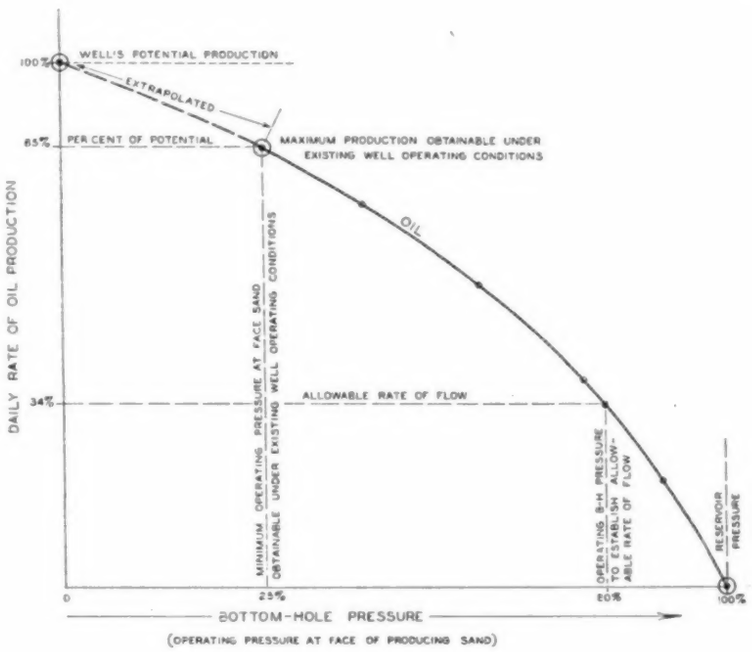
Under artificial factors are included the depth, size of hole and penetration in the producing formation, method of completing well, that is, how the well is cased, whether the producing sand is open or has liner or screen, method of producing, and mechanical equipment in the well.

A change in any one of the natural factors, other than those due to depletion, would involve every well in the pool, hence, to change them voluntarily would be a co-operative undertaking requiring the consent of the other operators in the pool, assuming that the acreage was held by a number of interests. Repressuring is an example of a co-operative enterprise that would bring about changes within the reservoir or in some of the natural factors. Those subject to appreciable changes are pressure, saturation and oil and gas distribution. All others, excepting, probably, temperature, can be considered fixed.

Quite different are the artificial factors. All are subject to change—sometimes very violent change—at the will of the individual operator. They differ greatly in the frequency and degree of change, however. Diameter of hole and penetration in the producing formation usually remain fixed during the producing life of the well. Also the size of casing string is seldom subject to change during the life of a properly completed well. Almost all other artificial factors are subject to frequent change during the well's producing life.

To realize the greatest benefit from the natural conditions within the reservoir, certain hole diameters and penetrations in the producing formation will be found more favorable than others. Diameter of hole will be governed chiefly by mechanical considerations of drilling, while the penetration will depend mainly on the thickness of the

producing sand, porosity, saturation, distribution of oil and gas, texture of the producing formation, and the presence or absence of water. Though the natural conditions within the reservoir are assumed to be constant, the potential rate at which a well produces can be varied by varying the diameter of the hole, the penetration, or both, in the producing formation. From the individual operator's viewpoint, the size hole and penetration that will enable him to make the best use of the gas or other source of energy within the reservoir in bringing the oil into the hole, will be to his advantage, but they should not injure the energy rights of offset operators if the pressures within the pool are kept uniform. The operator having the hole of proper size and penetration will be rewarded by a lower lifting cost than that of his neighbor with a hole of improper size and penetration. Nor does it follow that the largest hole diameter will be the most advantageous. This will depend on reservoir conditions. Too great a penetration might also work to the disadvantage of the well operator so far as making efficient use of reservoir energy is concerned. Both penetration and diameter of hole, if judiciously limited, might be considered as effective chokes and safeguards under certain reservoir conditions, and tend to maintain a steady flow of oil into the hole with a minimum expenditure of energy.



Hypothetical rate-of-production well curve showing how potential oil production might be obtained from bottom-hole pressure measurements. Note that bottom-hole pressure can be determined for any desired rate of flow.

With reference to reservoir conditions and using them as a basis to determine the potential production of a well, it can be realized from what has already been discussed that the only factors that can be legitimately considered as influencing the rate of flow into the well are the natural conditions existing within the reservoir (natural factors) and the penetration and diameter of hole in the producing formation (artificial factors). Reservoir conditions (natural factors) must be accepted as they are, or as they may be modified by the common consent of the operators in the pool, but the artificial factors, diameter and penetration of hole in the producing formation, is assumed to be the inherent right of the individual operator to decide so long as he does not injure the rights of other operators in the pool. Were sufficient information regarding sub-surface conditions available, all operators in a pool might agree among themselves regarding the diameter and penetration of wells in the producing formation. Such an agreement in force in a pool where water encroachment is imminent would be a benefit. Promiscuous shooting of wells to the detriment of other wells in the pool would be eliminated. So long as the operating pressures at the sand face to conform with other wells in the pool were maintained, the individual operator would be within his rights to operate his well in any manner he chooses. If positive measurements are made at the face of the producing formation, it eliminates all artificial factors influencing flow into the hole, except diameter of hole and penetration.

Another exception should perhaps be mentioned here; that is, where liners or screens are used. Screens or liners of the proper type, however, will maintain, but not retard, the flow of oil into the hole.

Assuming that operating pressure measurements can be made at the sand face and a continuous reading furnished at the surface, and knowing that the rate at which a well flows oil into the hole is a function of the operating pressure at the sand face, a well's potential can be determined within limits of practical accuracy.

A well may be prevented from producing its potential production by limitations due to size and length of flow string. It may be able to produce only a small percentage of its flow capacity into the hole. Here might arise the question, what is the use of making a determination of potential greater than can be lifted to the surface? True, present methods of producing wells may be cause for bringing up this question, but who can safely predict what future developments will be for lifting oil to the surface as fast as it comes into the hole. Certainly, if the operator is to depend on reservoir energy only, there is a great limitation placed on the rate at which oil can be raised to the surface.

Good operation demands the greatest utilization of gas energy for bringing the oil into the hole. The matter of lifting the oil to the surface should be considered as a separate problem. There may, or may not be, sufficient gas energy accompanying the oil into the hole to lift it to the surface. Only if the gas energy accompanying the oil into the hole is insufficient to lift the oil to the surface should it be necessary to supply energy from a source extraneous to the reservoir. Everyday examples of such extraneous sources are the gas-lift and mechanical pumping methods resorted to when the reservoir energy becomes depleted and is insufficient for oil-raising purposes in the well.

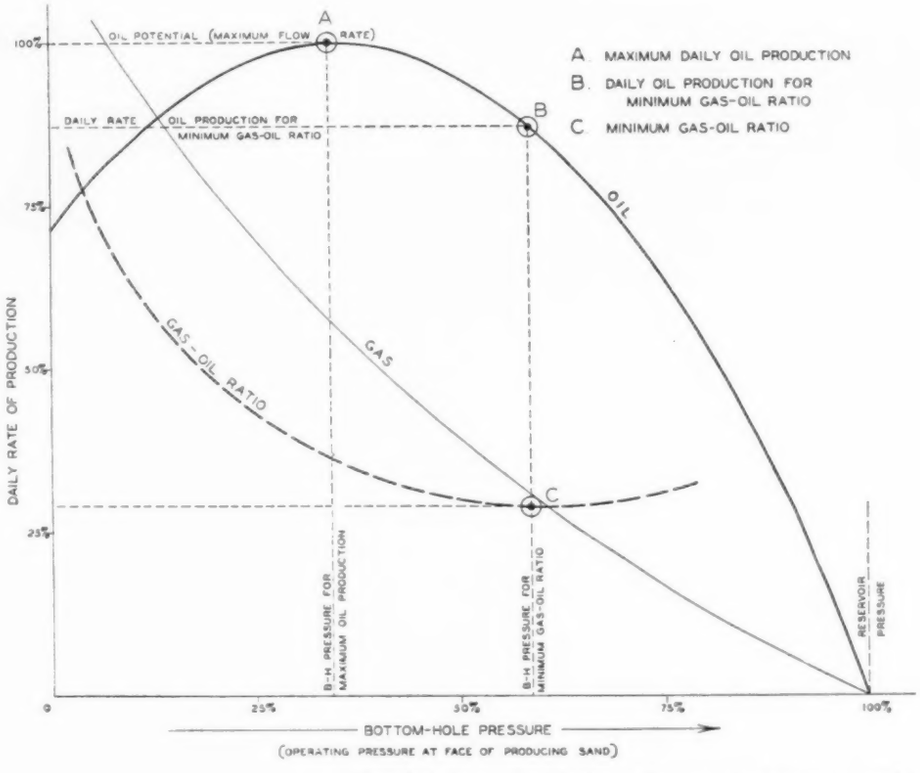
If the potential production of an oil well is the maximum rate of oil flow into the hole, how is this maximum rate to be determined? There is evidence to show that the maximum rate at which oil will flow into the hole is not necessarily when the pressure at the sand face is least, hence, it is a fallacy to assume that the lower the pressure at the sand face the higher the rate of *oil* flow into the hole. If the volume of gas dissolved in or associated with the oil in the

sand is relatively great, there will be a certain pressure at the sand face, at which the rate of oil flow into the hole will be a maximum. What this certain pressure is will depend on physical conditions within the producing formation as well as the amount and character of the gas with the oil, and the character of the oil itself. Excessive slippage of the gas past the oil in the producing formation under certain critical conditions of flow accounts for obtaining a maximum point of flow into the hole above atmospheric pressure. From a study of laboratory results, Chalmers[1] is of the opinion that greater benefits accrue by taking advantage of the energy stored in the dissolved gas by allowing the gas to expand from solution. The observation is also made by this investigator that gases of higher molecular weight as an expulsive medium are less effective at higher than at lower pressures, and also as a medium for gas-lift flow.

Instead of controlling the well by observation of flow pressures at the casinghead the rate of flow should be controlled by observation of bottom-hole pressures. Gas-oil ratios and their corresponding rates of oil flow for the whole range of pressures from zero to the reservoir pressure at the face of the sand could then be determined. Such a determination would give the potential production of the well. It would also indicate what would be an equitable rate of flow for the well and the bottom-hole pressure necessary to establish and maintain it. A series of operating pressure measurements at the face of the sand obtained while the well is producing is infinitely more desirable than indirect methods of questionable accuracy from surface flow measurements that are at present in use. Tests were made recently on solubility of natural gas in crude oil under field conditions by taking samples of gas-oil mixtures from the casinghead of wells in Kettleman Hills field, California.[2] Prelimmary findings show that the selective solubility plays an important part in changing the amount of gas in solution at various pressures. Lindsly[2] calls attention to the progressive action of selective solubility which heretofore has been almost neglected when discussing gas-oil ratios in the sand. Even at low pressures in an originally high-pressure field the action of selective solubility is greater at high pressures if there is a large proportion of natural gasoline constituents present in the oil. This is one of the strongest arguments for the development of the practice of taking bottom-hole pressures in a well. How else, unless this is done, are engineers to compute with any assurance what is the best method by which to produce a well so as to obtain the maximum ultimate recovery at the lowest cost per barrel, the chief desideratum in oil production.

Were an instrument available that would measure the operating pressure at the face of the sand and furnish readings at the well head the testing of an oil well could be accomplished without the necessity of an open-flow test or much interference with the well's producing routine.

In the average well a number of operating pressures at the sand face with their corresponding rates of flow could be obtained covering a sufficiently wide range to plot curves as shown in the accompanying illustrations. While it might not be possible to reduce the pressure at the sand face to atmosphere because of the friction head in the flow string, enough points could possibly be obtained to plot a curve from which by extrapolation the maximum rate of flow into the well could be established. Two hypothetical curves of different type are shown on accompanying illustration. One is what might be expected from a well in which it is assumed the maximum rate of oil flow into the hole occurs when the pressure on the face of the sand is equal to atmospheric or zero gauge pressure, the other is what might be expected from a well where the rate of oil flow into the hole reaches a maximum with a pressure at the sand face greater than atmospheric pressure, and diminishes with an increase or decrease of bottom-hole pressure from this point. This curve also shows the rate of gas production and corresponding gas-oil ratios for different bottom-hole pressures. Particular attention is drawn to the fact that there are two points on the latter curve that have the same daily rate of oil production but with a much larger gas-oil ratio and a bottom-hole pressure in one case than the other. With a decrease in bottom-hole pressure the flow of gas will increase until its critical flow velocity



Hypothetical rate-of-production well curve showing how potential oil production might be obtained from bottom-hole pressure measurements. Note also that maximum rate of flow may not occur at the lowest bottom-hole pressure.

1 "Recent Studies on the Recovery of Oil From Sands," by Joseph Chalmers. Petroleum Development and Technology, 1930. A. I. M. E.

2 "Preliminary Report on an Investigation of the U. S. Bureau of Mines Regarding the Solubility of Natural Gas in Crude Oil," by Ben E. Lindsly. Paper presented at A. I. M. E., February, 1931, New York meeting.

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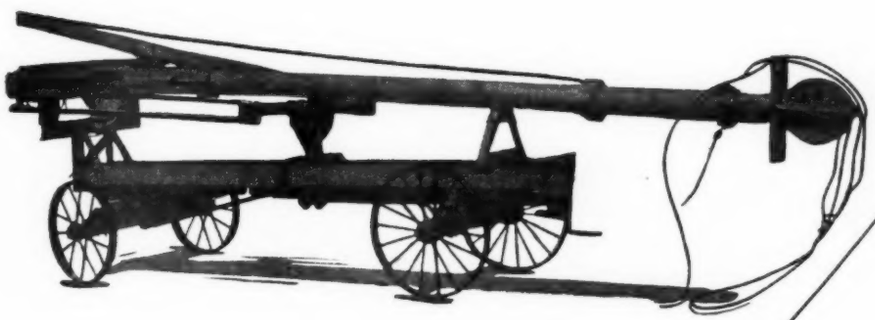

Mast will safely handle 20,000 pounds when properly guyed. This is equivalent to 3000 feet 2-inch tubing filled with water and a string of $\frac{5}{8}$-inch sucker rods, or 2000 feet of $2\frac{1}{2}$-inch tubing filled with water and a string of $\frac{3}{4}$-inch sucker rods.

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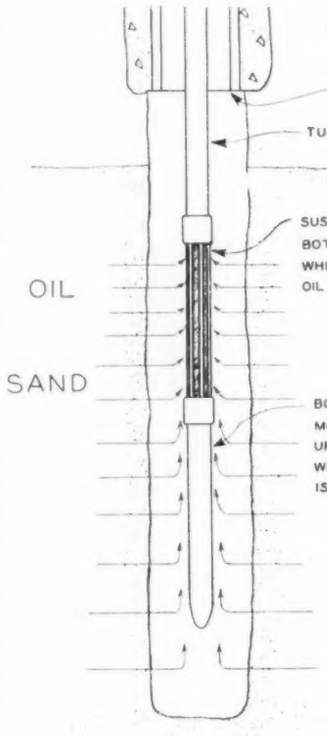
is reached. Oil with large volumes of gas dissolved in it may not show an increased flow with a decreased bottom-hole pressure. If a well were opened up gradually after being closed in, and the bottom-hole pressure gradually reduced, the volume of gas would increase as the pressure on the face of the face of the sand was lowered. Instead of the following a uniform increase in the oil will gradually rise to a maximum then diminish as the pressure at the face of the sand is further reduced. The gas in its haste to reach the well and by virtue of its greater mobility than oil, might be thought of as pushing the oil aside, and if the pressure and volume conditions are right, a condition may be reached when nothing but gas will be produced, the oil flow having been entirely shut off.

Several significant facts are apparent from a study of these curves. First, the maximum rate of flow into a well is not necessarily at the lowest bottom-hole pressure. Second, the point of maximum oil flow is not necessarily the rate of flow which gives a minimum gas-oil ratio; and, third, there may be a range of bottom-hole pressures, within which for each rate of oil flow there will be two different bottom-hole pressures and two different gas-oil ratios. Information of this nature would be invaluable in analyzing a well's performance, and indicates definitely the most suitable size flow string for the well. From a comparison of well curves with the size sole and penetration, it would be possible to determine with close accuracy the distribution of oil and gas in the pool. It would also give some indication of the character and texture of the producing formation. Having obtained rate of production curves for every well in the field, all obtained at approximately the same time and with a like number of wells producing at similar rates from the reservoir, an equitable rate of flow could be determined for each well. Adjustments could be made to allow for marked variation in sand conditions and unequal distribution of oil and gas in the reservoir. Wells having excessive gas-oil ratios wou'd come in for special consideration to prevent excessive drainage of gas energy. Instead of working blindly in regard to conditions within the reservoir, bottom-hole pressures and corresponding rates of oil and gas production would provide tangible information, the intelligent use of which would redound to the benefit of every operator in the pool.


CASING
TUBING FLOW STRING
SUSPENDING NIPPLE FOR BOTTOM-HOLE INSTRUMENT WHICH DOES NOT OBSTRUCT OIL FLOW INTO TUBING
OIL
SAND
BOTTOM-HOLE INSTRUMENT MEASURING OPERATING PRESSURE AT FACE OF SAND WHILE WELL IS FLOWING AND FURNISHING CONTINUOUS READING AT SURFACE

How a bottom-hole pressure gauge might be used to determine the potential oil production of a well.

Bottom-hole pressure tests could be made at frequent intervals as local conditions dictated and rates of flow adjusted accordingly. These tests could be made a part of routine producing operations. These data, systematically gathered and given thorough study would suggest further applications and be an effective means of fostering good production practice. One of the greatest benefits that would accrue to the oil industry would be the removal of that bogy "Production of a Pool," and place estimates on a sounder and saner basis. Knowing the amount of oil and gas taken from each well and the corresponding effect on bottom-hole pressures, more accurate estimates of the potential oil and gas reserves in a pool could be made.

Aside from its usefulness as a tool for prescribing allowable rates of flow, periodic determinations of well potentials made systematically, should be looked upon as a necessary part of good production practice and become a part of field routine. Information of this kind is positive and convincing even to the field man who ordinarily is inclined to stick to rule-of-thumb methods.

It seems strange that though many suggestions have been put forward for utilizing gas energy in the production of oil for greater ultimate recovery and lower per-barrel costs, few have made any reference to the practicability of obtaining the necessary information that wou'd assist in bringing it about. Also panaccan suggestions have been made regarding allocation of gas energy in a field, and, while it is true, that they serve a good purpose by stimulating thought and arousing interest, they are too often made with an utter disregard of the variable sub-surface conditions usually encountered in an oil field. There is litt'e need today to convince anyone of the merits of proper gas energy utilization, but the practicability of allocating it equitably is one of the stumbling-blocks in any curtailment program. Again quoting from recommendations submitted to the California Statewide Committee on Curtailment, "If all crudes were of the same character, and if all fields were in a fairly advanced state of development, the ideal basis of curtailment would be to allow each field to produce a percentage of the total allowable equal to its percentage of the known reserves of all the fields. It is obvious that this ideal basis of curtailment is impossible of achievement in view of the varying conditions of producing areas, and, therefore, theoretical considerations must give way to practical considerations. For example: old, fully developed and greatly dep'eted fields should not be curtailed to the point where ultimate recovery can be said to be seriously reduced." This illustrates the difficulties confronted in actual field practice. Our conception of a reservoir containing oil, gas, and gas energy, assumes that the nature and character of the gas can, for all practical purposes, be considered uniform, hence, relative amounts of gas energy at any time in the life of the pool can be compared on the basis of volume, assuming the volumes compared were produced from the pool at the same existing reservoir pressure. Gas-oil ratios would serve in such cases for comparing the energy used at two wells or more in the same pool at the same time, but not for comparing wells in different pools.

Having outlined a method for obtaining the potential production of a well, its successful application is predicated on instruments being available for measuring bottom-hole pressures. To obtain bottom-hole pressures and corresponding rates of flow requires an instrument that can measure the pressure at the face of the sand and furnish continuous readings at the surface. Here is one of the stumbling-blocks to putting the method outlined into practice. Fortunately it is not an insurmountable barrier. An instrument of the type discussed, suitable for this work, is having the close attention of at least two prominent instrument manufacturers.

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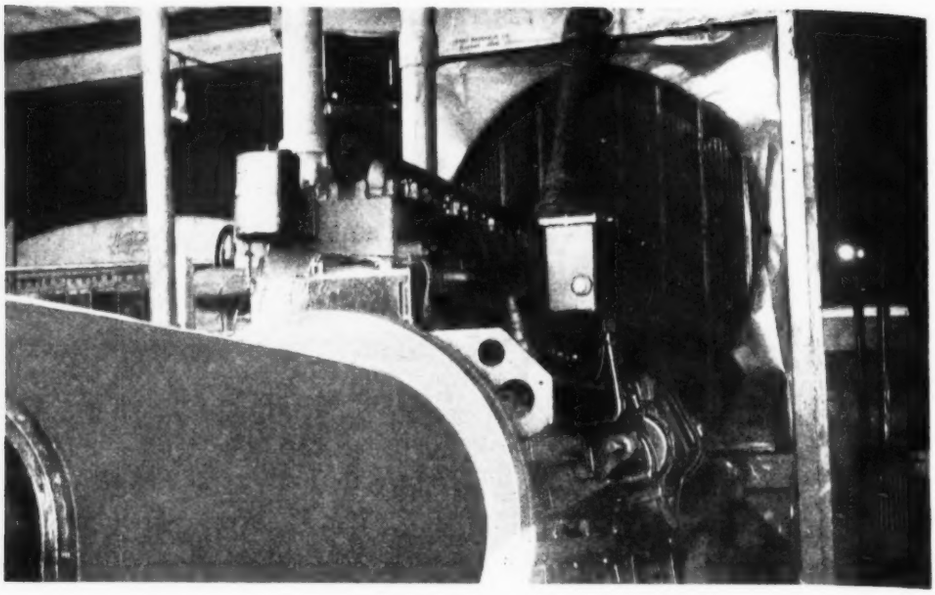

The engine used for driving draw-works.

An Oklahoma

Deep Test Drilled With Gas Engines

MEADE Brothers Drilling Company, of Tulsa, a short time ago completed a wildcat test for the Prairie Oil & Gas Company and the T. B. Slick estate on which an interesting mechanical hook-up was used. The well, known as No. 1 Parkinson, is located near Purcell, Okla., about 35 miles south of the Oklahoma City field.

The rig made a good drilling recording, reaching a total depth of 6,656 feet in 108 days elapsed time. The test was started on September 25, 1930, and abandoned as a dry hole on January 9, 1931. During this time the well was shut down 11½ days awaiting the setting of the cement, and several additional days for minor repairs and because of rain.

Only one string of casing was set in the hole other than the 15½-inch surface pipe, which was set at 270 feet. Surface pipe cement was allowed to set for two and one-half days. The final string of casing was nine-inch O. D. set at 5,640 feet, a depth to which very few strings of nine-inch casing have been run in Oklahoma. Nine days were allowed for hardening of the cement.

The location of the well, 35 miles from the nearest production, made fuel conservation important, the fuel being purchased gas. How well this conservation was effected is evidenced by the fact that the total consumption of gas amounted to only 9,797 M. cubic feet, or an average cost for gas of 29½ cents per foot drilled.

The well was drilled with a gas engine-powered rotary. Three Waukesha engines were used, each of 300 horsepower, and consequently interchangeable in case of an emergency.

One engine was used for the operation of the rotary table and drawworks. This was placed directly in the rear of the drawworks, to which the power was transmitted through a reversible clutch by texrope drive. As the jack shaft in the drawworks had been designed for steam operation, a reduction in speed was necessary. The maximum engine speed was 1,000 revolutions per minute and the maximum speed on the reversible clutch 330 revolutions per minute, or approximately a 3-to-1 reduction from the engine to the reverse clutch. From the clutch to the jack shaft a further reduction was secured by differences in sprocket sizes.

The slush pumps were placed between the rig floor and the slush pits. Each was driven by a gas engine through a series of texrope-driven gears with a final reduction of 20 to 1 from the prime mover to the pump.

Schematic diagram of derrick floor arrangement.

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Preparing to move derrick back into position after flood.

View of Red River

Taken at

. . . LONE STAR Bridge Across Red

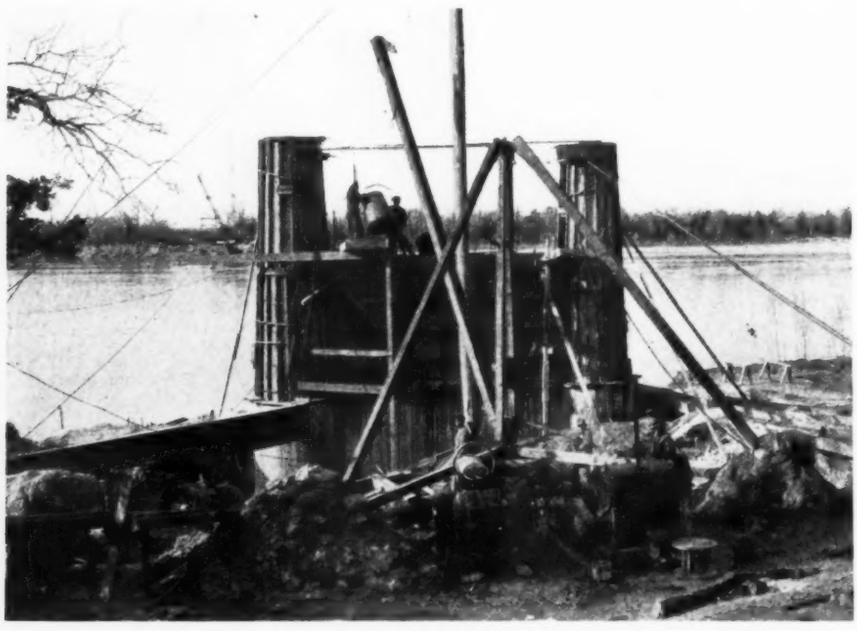
ACROSS the treacherous Red River, which separates the states of Oklahoma and Texas, the Lone Star Gas Co. is building an 800-foot span suspension pipe line bridge near Gainesville, Texas. A single 16-inch line, with loop expansion joints on either end, will traverse the bridge, replacing three 10-inch lines now submerged in the river. It was considered advisable to replace the latter lines in this instance, in view of the fact that the Red River is an exceptionally difficult stream in which to anchor crossings, since its sands are constantly shifting, lines often bury themselves deeply and frequently drag some distance down stream. Furthermore, salt water accelerates corrosion of the lines and during flood season the stream is gruelling on them. Under such conditions maintenance and repair costs have been entirely too high.

However, with the crossing above water, possibilities of breaks will be reduced to a minimum and, when occurring, can be repaired more easily and quickly. Additional maintenance will consist merely of cleaning and painting exposed pipe.

The bridge is designed ultimately to carry two 16-inch lines separated by a walkway; but at present, only one line will be laid. From anchor to anchor the length of the bridge will be 1,960 feet. The span will be extraordinarily long—840 feet. It will be suspended by 2¼-inch cables having a breaking strength of 208 tons. The weight of each length of cable is about 16,000 pounds.

To fortify the bridge against side stresses 1¾-inch wind cables will be used. These will pass around cantilever trusses extending outward from either side of the main piers and to the center of the span. Suspension cables will be attached to U bolts set in concrete anchors on both shores.

Because of less favorable soil conditions the larger anchor is built on the Oklahoma side. It is of concrete and weighs approximately 504,000 pounds. An excavation 15 ft. deep was dug to hold the 10 by 13 by 25-foot concrete block, and before the concrete was poured, 20 piles, 30 feet long and 10 inches in diameter, were driven 27 feet in the ground, leaving three feet exposed for a bond.



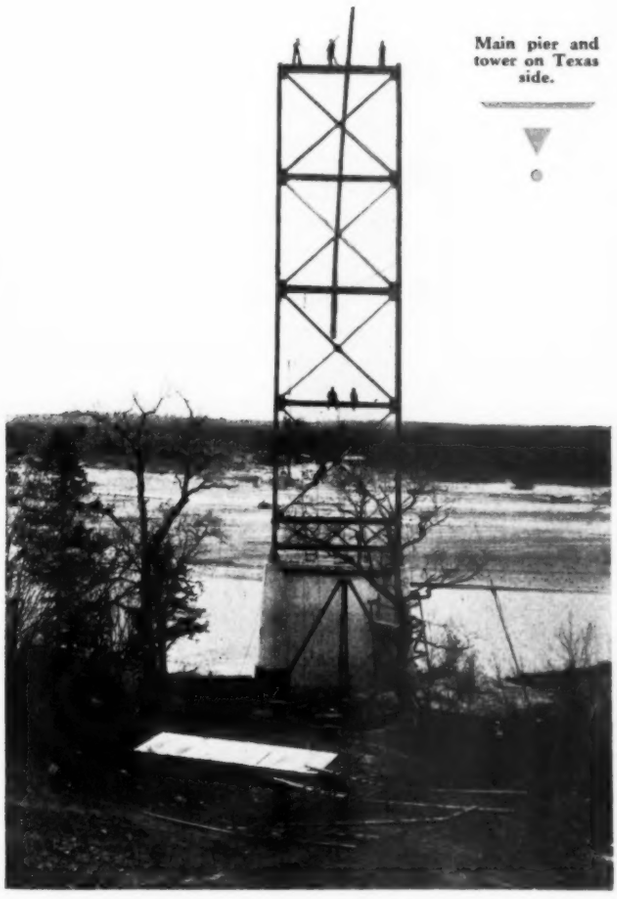
Pouring concrete for Texas side main pier.

Taken at point of crossing.

Building Pipe Line River *at* GAINESVILLE

Soil conditions on the Texas side were more favorable and piling was unnecessary. Instead, six 18-inch pile holes were drilled in the bottom of the 10 by 10 by 25-foot pit. These were filled with concrete at the time the crews were pouring it for the anchor.

Construction of the main piers offered several obstacles which sprang up from unexpected sources. These were surmounted by ingenuity of the engineers. In sinking the caissons in which concrete for the piers was poured, one steel tube struck a submerged line near the Texas shore. On that particular side of the river the tube had to be sunk 41 feet and, upon striking the submerged line, the tube was ten feet from that depth. Efforts to move the line being unsuccessful, it was decided to dig around the line, cut it and weld a loop around the caisson. After necessary excavating, timber-work was put in to prevent sand from caving, header gates were closed and the line was cut with pipe rippers. A welded right-angle offset was made so it would swing around and a few inches clear of the tube. When it was wormed into position it was joined to the two free ends of the river line with sleeve-type couplings.



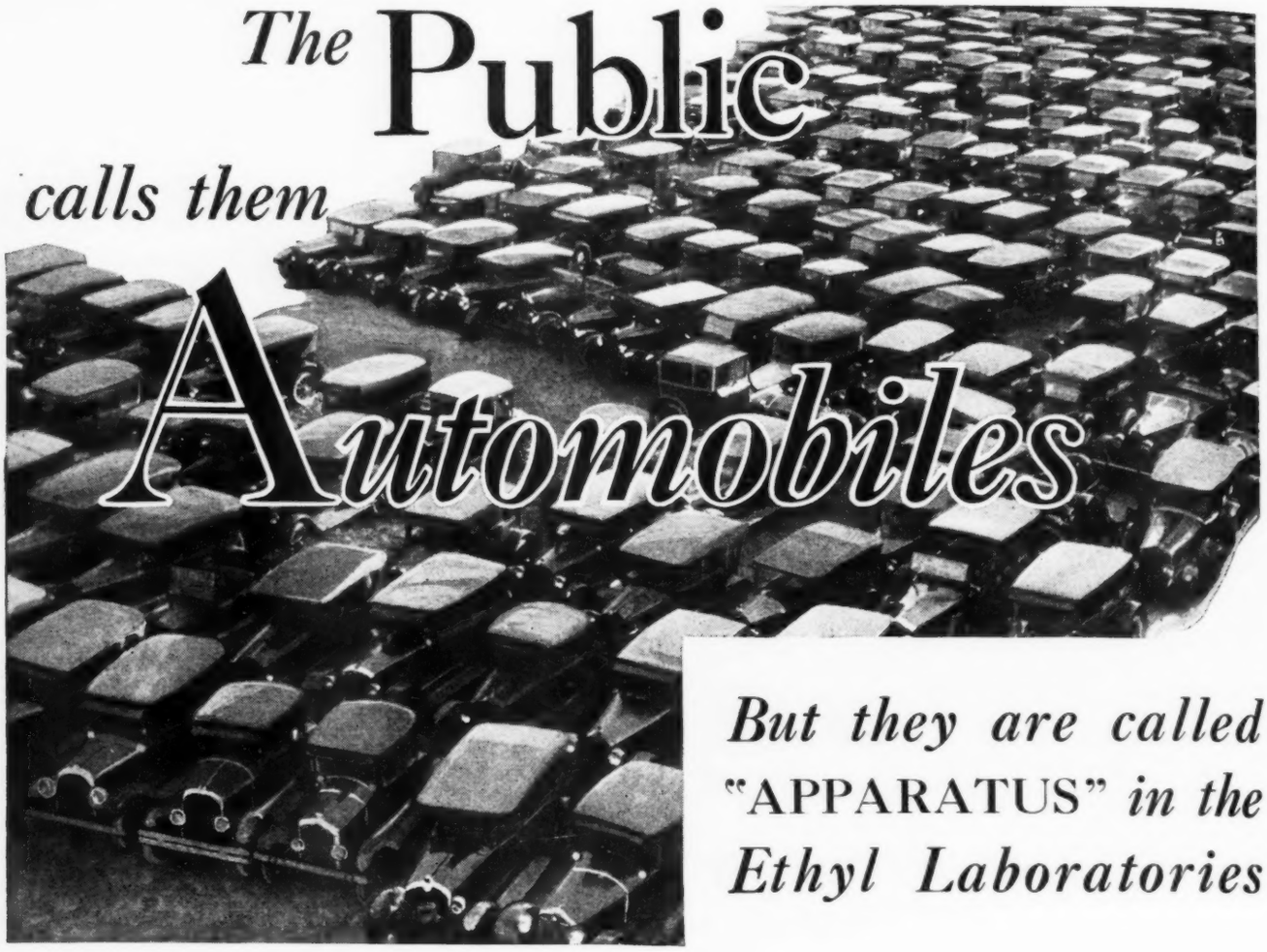
Main pier and tower on Texas side.

On the Oklahoma side the caisson had to be sunk 61 feet to hard-packed sand. Four feet from the bottom, one of the tubes froze. An attempt to free the latter by jetting with an air blast was unsuccessful. The next step was to load a girder placed across the tube with 100 tons of sacked sand. This failing, cement to the amount of 107 sacks was pumped around the tube to prevent sand and water from encroaching at the bottom. Workmen then dug the remaining distance through hard sand. Each shaft was belled at the bottom to give the concrete a more solid footing.

When completed shortly, the bridge will be seven feet above maximum high water. Suspension cables will have an 80-foot sag when in place. There being a difference of 42 feet in elevation of the two anchors, it was necessary to build a rest pier to bring the back stay to correct relative height on the Oklahoma side. Both main towers are 140 feet above low water.

Caisson loaded with 100 tons of sand in an unsuccessful effort to drive it down.

The Public *calls them* Automobiles



But they are called "APPARATUS" *in the Ethyl Laboratories*

TESTS in the dynamometer room are conclusive only in so far as they are confirmed by tests under actual road conditions. Before the facts you read are released from the Ethyl Engineering Laboratories, they are checked by whatever apparatus and under whatever conditions are necessary to make them conclusive.

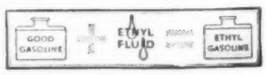
Many times that apparatus is the car you helped design; used either in stock model or with engine alterations to accommodate the test. A large fleet of cars and trucks of many different makes is a part of the apparatus at Ethyl Laboratories. And as these are worn out and destroyed by gruelling tests they are replaced with new models.

During the past three years, over 500 cars have been used in this way. At the present time, over fifty experimental cars are on the road, testing operation under compression pressures as high as 175 pounds. Before the results appear in advertising pages such as these, the tests will have been confirmed by more than five hundred thousand miles of typical operation.

All these cars, and in fact all the laboratory tests conducted at Ethyl Research Laboratories during the past three years, have had one end in view; namely, to forecast the trend of automotive progress and to establish data which would aid those creating tomorrow's designs in taking full advantage of the qualities of Ethyl Gasoline.

It is quite clear which way automotive progress is going. Higher compression pressures offer positive advantages which cannot be overlooked. The widespread distribution of Ethyl Gasoline has made possible the prescription of a fuel of its high

WITH ETHYL BRAND OF ANTI-KNOCK COMPOUND ETHYL GASOLINE CORPORATION NEW YORK U.S.A.



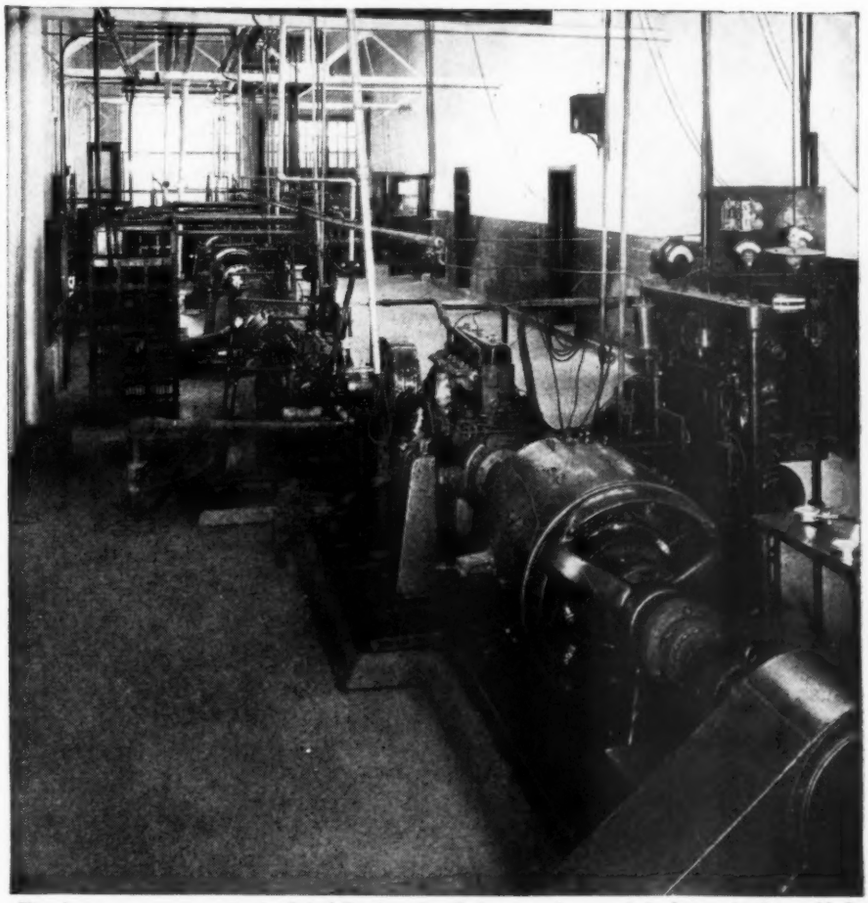
The Ethyl emblem on any pump stands for tested gasoline of Ethyl quality. Constant inspection of gasoline takes from Ethyl pumps throughout the country guards this standard. Ethyl Gasoline is always colored red.

THE ACTIVE INGREDIENT USED IN ETHYL FLUID IS LEAD

250,000 PUMPS NOW BEAR THE ETHYL EMBLEM

The driver of any car, anywhere, is never far from an Ethyl pump

When writing ETHYL GASOLINE CORPORATION *please mention The Petroleum Engineer*



The dynamometer room in the Ethyl Engineering Laboratory is one of the largest in the world. In this room and in other parts of this laboratory, thousands of tests have been conducted and the many problems solved for the automotive and the petroleum industries. These tests have assisted materially in developing automobile performance to its present high standard.

anti-knock qualities; and the keen competition of automotive manufacturers for greater economy, faster acceleration, and lighter weight per horsepower is making higher compression pressures necessary.

The day has passed when manufacturers can hope to build an automobile motor which will operate satisfactorily on any non-premium fuel of wide distribution, to compete successfully in performance and economy with lighter engines of equal or greater power designed to operate on Ethyl Gasoline.

The following comparison of compression ratios shows this trend:

(On basis of models)

Compression ratio	1926	1928	1930	1931
Less than 4.5 to 1	33%	12%	2%	1%
4.5 to 5.09 to 1	64	67	33	32
5.1 to 1 or over	3	21	65	67

Compression ratios of 5.2 to 1 (90 to 100 lbs.) will soon be considered quite low.

The grades of Ethyl Gasoline now sold on every road in the country will permit maximum performance under pressures ranging from 120 to 150 pounds (depending on the engine design). Over five million motorists are buying Ethyl Gasoline today; and are thus already using a fuel suitable to much higher compression pressures.

That automobile manufacturers will take advantage of this distribution of quality fuel to gain the superperformance sales managers are asking for, seems inevitable.

The increase from 100 pounds and lower to 120 or 150 pounds pressure offers as certain an opportunity for competitive superiority as did the earlier increases.

It is well to note here a list of results from completed tests of this type of compression engine which have been confirmed by actual road performance.

For a typical eight-in-line engine under varying compression pressures of 5.2 to 1—6 to 1—and 7 to 1—the higher compression ratios showed the following advantages:

Acceleration respectively 12% and 20% faster.

Top speeds respectively 4 and 7 m.p.h. higher.

Exhaust temperatures respectively 30°F. and 110°F. lower.

Heat dissipated to cooling water respectively 14,000 and 17,000 BTU hours less at 3,000 r.p.m.

Neither engine weights nor manufacturing costs need be increased to gain these advantages of higher compression pressure. The way is open *now*. Ethyl Gasoline Corporation, Chrysler Building, New York City.

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ETHYL GASOLINE

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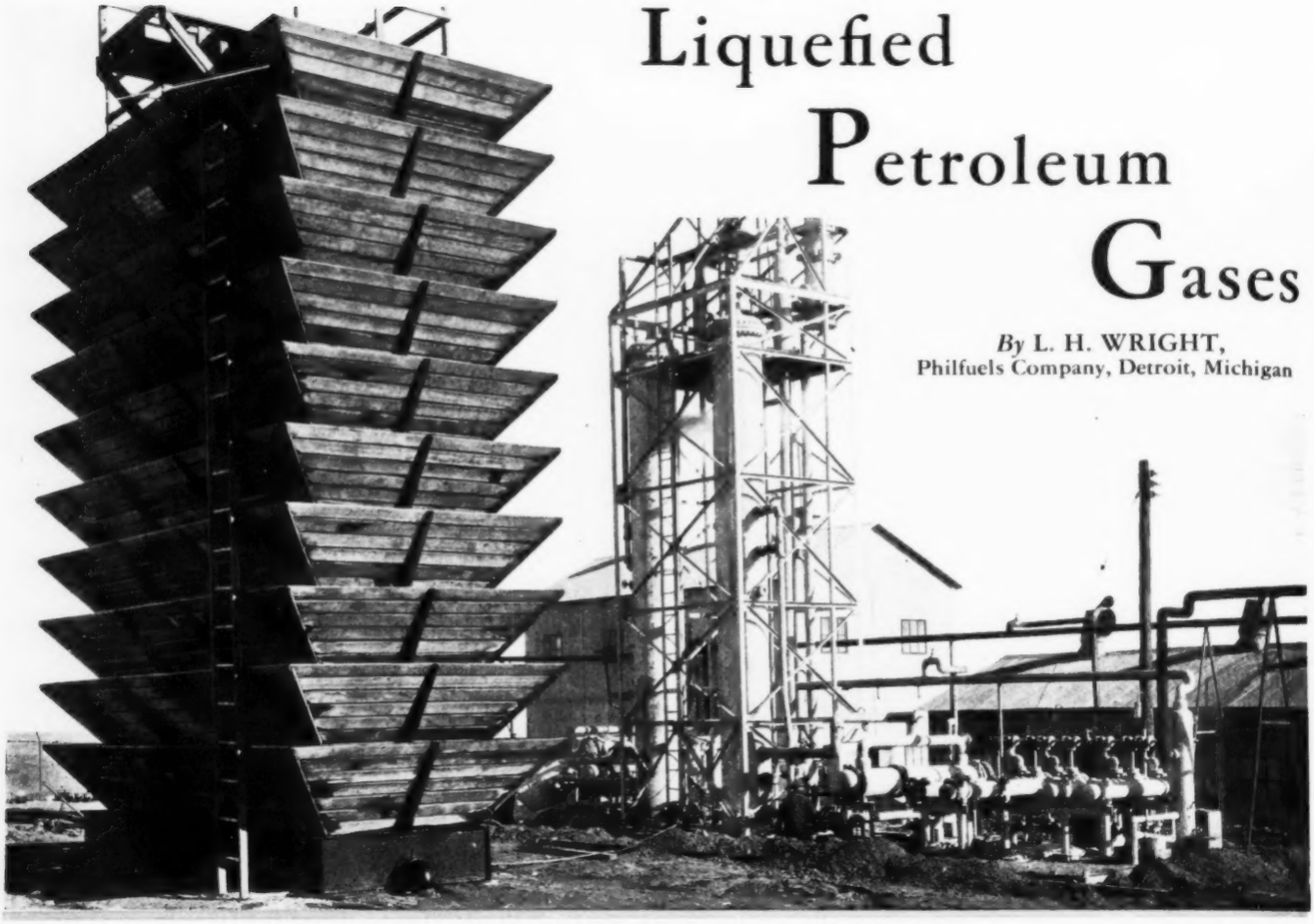
Liquefied Petroleum Gases

By L. H. WRIGHT,
Philfuels Company, Detroit, Michigan



Plant for manufacture of liquefied petroleum gases.

THE first liquefied petroleum gas was produced from petroleum about a half century ago. Pintsch gas, a compressed gas made by cracking oil, was the forerunner of Blaugas, the first liquefied petroleum gas manufactured and sold commercially in the United States. While Blaugas was made from the liquefiable gaseous constituents in the gas, resulting from an oil cracking process, it has long been realized that natural gas offers the cheapest source of liquefied hydrocarbon products. The increased supply of raw natural gasoline, the present chief source of liquefied petroleum gases, and the demand for more stable grades of natural gasoline have made available large quantities of the more volatile fractions, from which the liquefied gases are made. The possibilities of creating markets for the large quantities of liquefiable hydrocarbons were visualized when the natural gasoline industry was in its infancy, but their extensive development depended upon the solution of many technical problems relating to the manufacture, transportation and utilization of the products and the formulation and execution of plans pertaining to their merchandising.

Following the recent pioneering period of the essential technical developments, the growth of the industry has been so rapid as to attract the attention of leaders of many kindred industries. Some idea of the increase in business can be obtained from Table I[1], a tabulation of the quantities marketed in recent years, and from the accompanying graph a comparison of the growth of the liquefied petroleum gas industry with that of several other comparatively young industries.

PROPERTIES. Commercial propane and butanes constitute the predominant compounds composing all of the definitely established grades of liquefied petroleum gases. Butane is a gas at atmospheric pressure and at all temperatures above 26 degrees F. Propane is a gas at atmospheric pressures and all temperatures above —44 degrees F. Both are shipped under pressure as liquids in specially constructed tank cars or cylinders, thus providing economical transportation as well as ease in handling. They are used as gases, the freedom from impurities making them ideally adaptable to industrial and domestic fuel applications and the high calorific value (2550 B.T.U. per cu. ft. for propane and 3200 B.T.U. per cu. ft. for butane) makes them easily adaptable to any requirement, inasmuch as a gas of any desired thermal value is obtained merely by diluting the high thermal value vapor.

USES. The uses to which these new and highly valuable fuels have been put have been determined to a large extent by the properties peculiar to each. Propane has been used chiefly as a domestic fuel for homes beyond the reach of city gas mains, while butane has been employed chiefly in the manufactured gas industry. Commercial applications of the two products will be discussed in more detail in the following paragraphs.

TABLE I

Marketed Production of Liquefied Petroleum Gases

Year	Gallons
1922	222,641
1923	276,863
1924	376,488
1925	403,674
1926	465,085
1927	1,091,005
1928	4,522,899
1929	9,925,698
1930	16,000,000

[1] E. B. Swanson, Bureau of Mines, June, 1930; December, 1930.

INDUSTRY'S IDEAL PIPE

HERE'S a point which should not be overlooked when considering pipe for service of any kind where corrosion is an important factor in determining pipe life.

Everyone familiar with pipe knows that rust and corrosion usually attack first those parts of ferrous pipe which have been worked cold, such as cut ends and threads, and that the maximum resistance to attack is usually at the surface of the metal.

Such is not the case with Toncan Iron Pipe—the alloy of refined iron, copper and molybdenum. It is the only ferrous pipe possessing the same degree of resistance throughout the entire wall thickness and remaining unaffected by cold working or deformation.

Toncan Iron Pipe is the ideal pipe for all corrosion installations where the pipe must be threaded, flanged, bent, Vanstoned or otherwise worked.

Details gladly mailed on request.

REPUBLIC STEEL
CORPORATION
GENERAL OFFICES: YOUNGSTOWN, OHIO

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PROPANE. This gas, due to its freedom from vaporization at extremely low temperatures, is by far the predominant one for domestic purposes and, because it is usually distributed in cylinders when used for this purpose, it is often referred to as "bottled gas". Consumers using it are served by one of the following methods:

(a) One Drum System. By this system one container of fuel is installed in a cabinet outside the customer's home or place of business. The vapor is piped from the top of this cylinder through a regulator providing a uniform reduced pressure to the domestic appliances. The fuel supply is replenished periodically by a tank truck and bills are sent to the customer at monthly intervals for the gas used the previous month. The customer, under this system, has a very close duplication of city gas service and, as well, the advantage of a low investment requirement. The single cylinder method obviously depends upon the close grouping of customers for successful operation but, where this condition exists, advantages of convenience and economy are quite evident.

(b) Two Drum System. This second method of "bottled" gas distribution provides the customer with two cylinders rather than one as used in the system described above. When the gas supply in one cylinder is exhausted the valve on the cylinder is closed and the valve controlling the gas supply of the full cylinder is opened. The empty cylinder is then returned to the distributor for refilling. This system offers the advantage of wider territorial activities to the dealer and has proved advantageous in serving scattered customers.

That bottled gas is becoming an extensively used commodity is shown by the report of the Bureau of Mines to the effect that, in 1928, there were 20,000 bottled gas customers; in 1929 there were 55,000 and, further, by an estimate[2] that there were over 100,000 customers early in 1930.

(c) Distribution of Undiluted Propane. The distribution of undiluted propane vapor from a central storage point through pipe lines also offers a means of gas service to small towns or suburban districts not supplied with city gas. The propane vapor of high calorific value is piped through a regulator directly from the top of a storage tank to the customer's home in undiluted form. There a small service regulator further reduces the gas to the desired pressure before it reaches the appliance. Since there are no power costs and labor costs need only include the part-time services of one man, the plant-operating expenses are very low. The investment cost is likewise low and the two features combined make this form of gas service quite attractive for serving localities to which it is adaptable. The gas service made possible to small towns by the undiluted propane system is certain to be taken advantage of in this age of modernization, and several small towns in addition to those already contemplating the service will undoubtedly be served by this system within the next year.

BUTANE. Butane, for the most part, has not been used as a domestic fuel, but, as mentioned, its principal applications are as a fuel for enriching manufactured gas, for use as a base material for manufacturing gas for industrial heating operations and for supplying the necessary gas required by gas companies' peak loads. These uses present quite interesting possibilities and are worthy of further discussion.

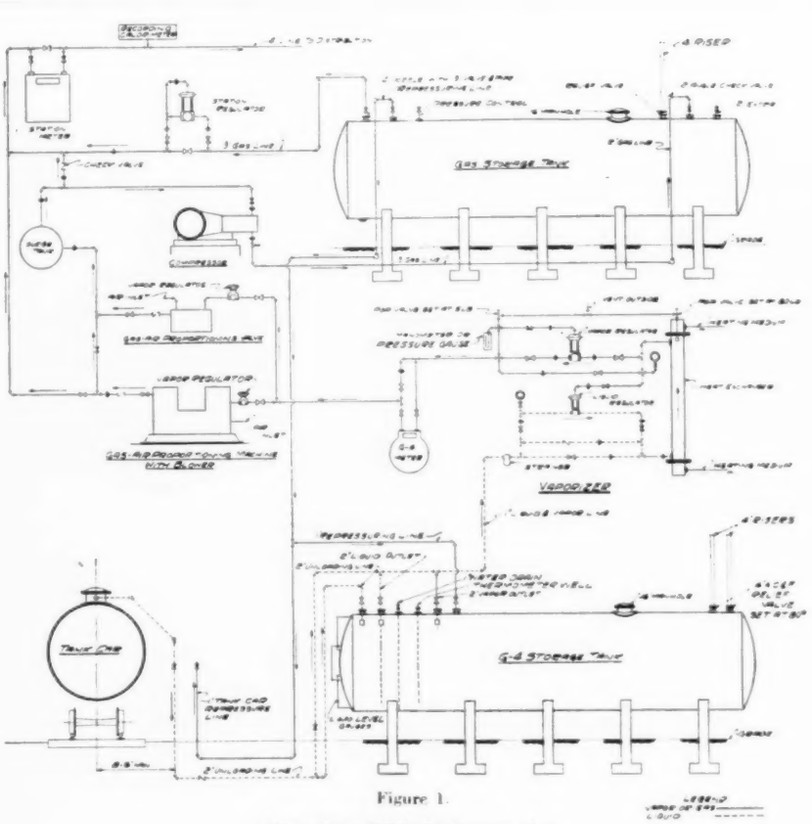

Figure 1.
Flow sheet Philfuels Process plant.

(a) Gas Enrichment. The use of butane instead of gas oil to carburet producer gas, blue water gas and others of relatively lower thermal value than the required calorific standard, has proved quite successful. The initial installation, in which butane was used to carburet about one and one-half million cubic feet of blue water gas daily, has been in operation approximately three years and has given very satisfactory results.

The process itself is simple, consisting of adding the vaporized butane to the gas being enriched until the desired calorific value is obtained. The equipment used in proportioning the two gases may embody any of the standard proportioning methods and may be operated automatically if the use of a controlling calorimeter is employed. Automatic control is not at all necessary for the production of a finished gas of uniform calorific value, but when used, the necessity of depending upon the gasmaker to note any fluctuation in the heating value of the gas is eliminated. Butane, as an enricher, offers the advantages of constant quality; one hundred per cent thermal efficiency; flexibility through the ability to care for peak-load and over-load conditions; no accumulation of light oils, gums or resins in the mains, thereby decreasing service complaints and expenses; decreased purification costs; and the lowering of generator maintenance through the reduction in recheckering expense. These advantages, in a large measure, tend to offset the slight price differential

[2] Gas Age Record, February, 1930. Progress of Liquefied Petroleum Gas Industry by G. G. Oberfell.

FIGURE 106-A ***with the one-piece screw-over bonnet and slip-on stay-on disc holder . . .***

THIS is the Standard Bronze Globe Valve that engineers are talking about. It is the Jenkins with the one-piece screw-over bonnet, and the slip-on stay-on disc holder.

The screw-over bonnet contributes great strength. Take the bonnet off and put it back repeatedly. It won't spring or distort . . . because it is made from a single piece of selected Jenkins bronze.

The slip-on stay-on disc holder is another advantage. Give the hand wheel of the valve a turn or so and the bonnet can be removed without danger of the disc holder falling off. Then give the wheel a reverse turn, and off drops the disc holder into your hand.

Your supply man can furnish these valves in globe, angle, cross and check, screwed or flanged. Write for Bulletin 141.

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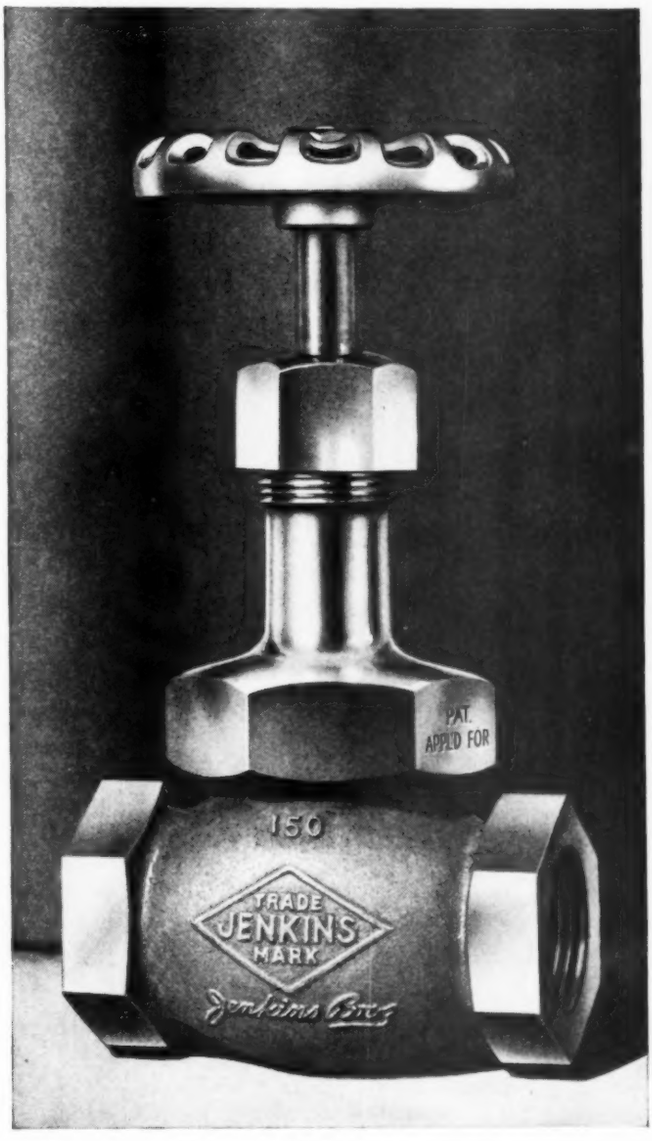
JENKINS BROS., Limited, Montreal, Canada; London, England
Factories: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Canada

Jenkins
VALVES
Since 1864

FIG. 106-A, *Screwed, Jenkins Standard Bronze Globe Valve, with one-piece screw-over bonnet, and slip-on stay-on disc holder. For 150 lbs. steam working pressure, or 250 lbs. oil, water, gas working pressure.*



JENKINS VALVES ARE ALWAYS MARKED WITH THE "DIAMOND"

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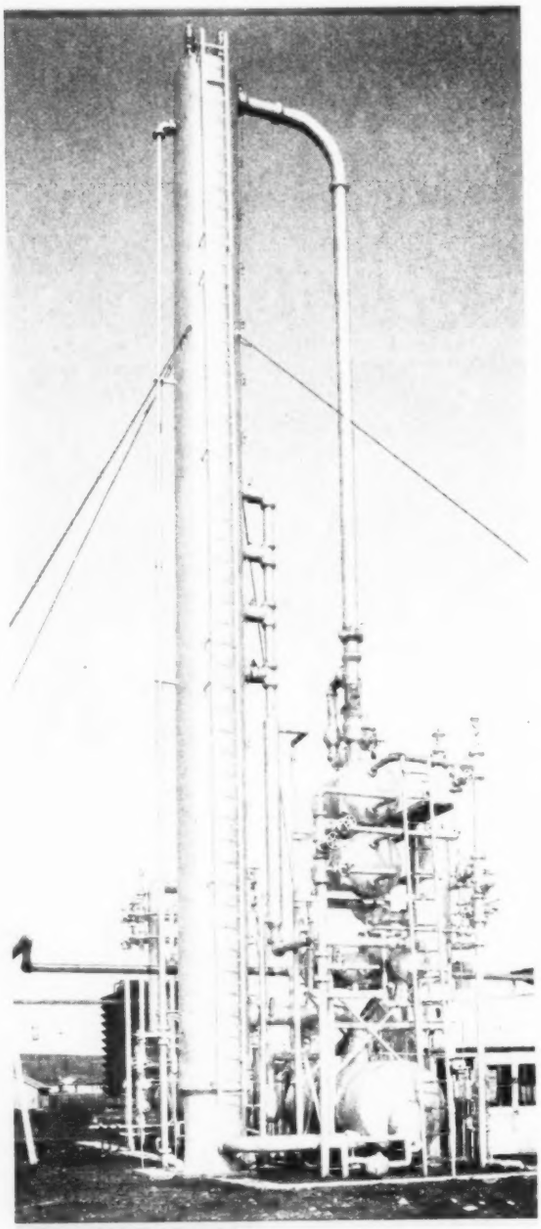
between butane and gas oil and, with the prospect that the future price difference between the two will be even less than at present, the use of butane for enrichment purposes will certainly become more and more widespread.

(b) Base Material for Manufactured Gas. The use of butane for the direct manufacture of city gas has been one of the most important developments in the industry in recent years. Its advent made gas service an economic possibility to approximately 700 towns in the United States which, three years ago, entertained little hope that its advantages would ever be available to them, since their requirements were not sufficiently large to warrant the installation of water or coal gas plants or the laying of mains for supplying natural gas.

Figure I is a flow sheet of the process which, briefly, operates as follows: Commercial butane is shipped in specially constructed tank cars and, as a liquid, is transferred under pressure to storage at the gas plant. The liquid gas is passed to vaporizer, where a sufficient amount of heat is supplied to vaporize it completely. The butane vapors leaving this device are reduced to a uniformly low pressure by a sensitive regulator located between it and the proportioning machine into which the vapor next passes. This machine automatically mixes the butane and air (any other non-combustible gas may be used, but air is most readily available) in the correct proportions to produce a finished gas of the desired calorific value. The gas-air ratio can be changed merely by turning a valve on the machine until the desired setting is obtained. Once set, the proportioning machine requires no further adjustment. The finished gas may be piped from the machine to a low-pressure holder, high-pressure storage or directly into the mains as necessity requires. The use of automatic control equipment makes the plant entirely self-operating and safety equipment is available to safeguard the plant against the occurrence of any serious operating difficulties.

The cost of a plant with a capacity of 140,000 to 170,000 cubic feet of finished gas per day, including building, site, railroad siding, liquid and gas storage and the necessary mechanical equipment, will vary from $15,000 to $20,000, depending, of course, upon the varying economic factors encountered in different localities. This low plant cost and the low cost of the finished gas make it possible to operate profitably plants in towns where as few as 300 customers are served. The remarkable possibilities offered in this virgin field have been responsible for marked activities in the past two years and, at the present time, there are butane-air plants operating in forty-five towns located in twenty different states in the territory east of the Rocky Mountains, as well as several operating and under construction along the Pacific Coast. Many additional towns have granted franchises authorizing the construction of plants during the coming spring and summer. Judging from the number of these franchises, it seems entirely logical to predict that the number of plants constructed within the next twelve months will materially exceed that of last year.



Stabilizing unit for separation of propane and butane from natural gasoline.

(c) Industrial Gas. During the past two years butane has been applied to practically all the phases of industrial heating and its use as an industrial fuel has increased rapidly. Such typical metallurgical operations as annealing, hardening, drawing, normalizing, plate heating, carburizing, forging, galvanizing, malleabilizing, die casting and preheating were all successfully accomplished. Likewise, excellent performance was obtained on such operations as core baking, drying, japanning, glass melting and motor block testing.

Commercial butane being one hundred per cent combustible, of constant thermal value and gravity, free from all contamination by sulphur, tar, resins, etc., and easily unloaded, stored and distributed, is an ideal fuel for operations requiring accurate furnace temperature and atmosphere control. The similarity of the burning characteristics of butane and natural gas makes it valuable as a "stand by" fuel for industrial plants using natural gas.

In the event that the supply of natural gas is impaired or interrupted, burners can easily and quickly be adjusted

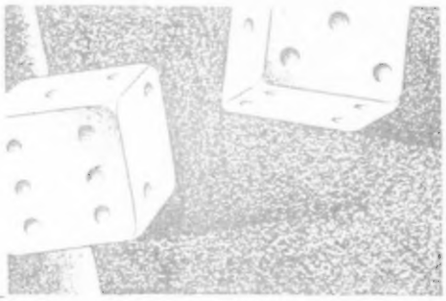
TABLE II

Comparative Prices of Butane and City Gas

Cost of Butane at Burner Cents per Gal.	Equivalent Cost of 530 B.T.U. City Gas Cents per M. Cu. Ft.
8	41.4
7.5	38.8
7.0	36.2
6.5	33.6
6.0	31.0
5.5	28.4
5.0	25.9

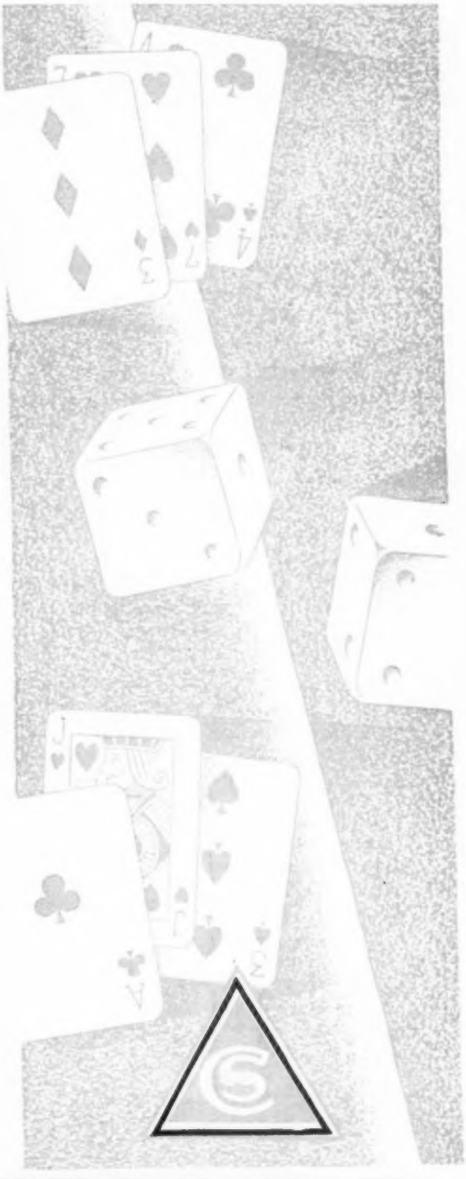
Note: The cost at point of origin would be two to four cents per gallon lower, primarily on account of freight charges.

If You Must Gamble Don't Do It With PIPE



PLAY SAFE!

YOUNGSTOWN PIPE



The loss of even a shallow well is a serious and costly matter.

In shallow wells—
deep wells—
cable tool wells—
rotary wells—
wherever you have use for pipe, use this good pipe.

"If Continental Sells It....There Is No Better"

THE CONTINENTAL SUPPLY CO.

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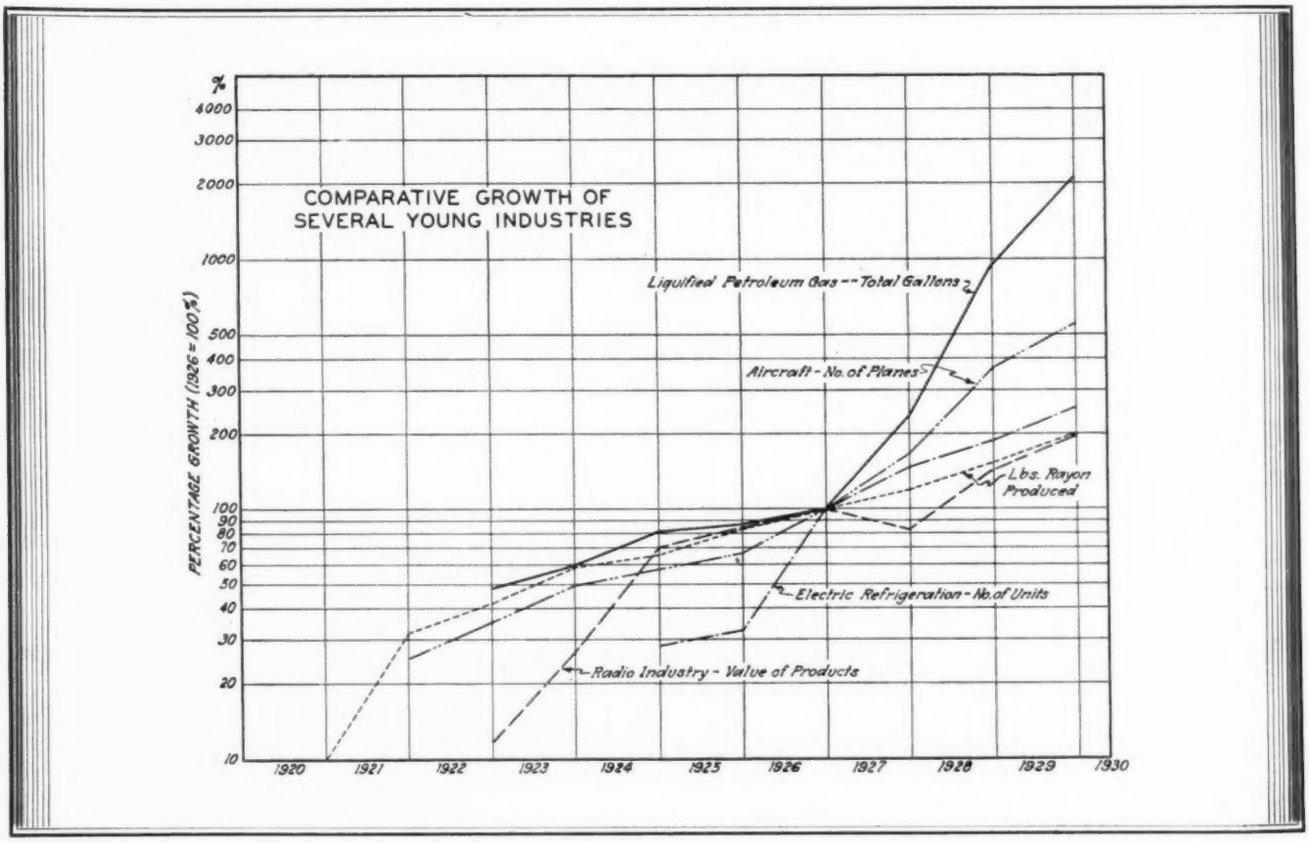
for butane, thereby eliminating a costly plant shutdown. When used as an industrial gas, butane is in direct competition with the product of the manufactured gas industry and a price comparison of the two is usually of primary consideration. At the present price range of from 2.75 to 4.00 cents per gallon F. O. B. Group III points for butane, it is, in most cases, cheaper than manufactured gas when a comparison is made on a strictly thermal basis. The foregoing table gives some interesting cost equivalents for various butane prices.

Its extremely low cost and many advantages have been responsible for the adoption of butane by many industrial companies in the past three years, and if the predictions of distributors hold true the quantity used in industrial operations in 1931 will be almost double that used in 1929.

A SURVEY by E. B. Swanson, Chief Petroleum Economist of the United States Bureau of Mines, shows that during 1930 the marketed production of liquefied petroleum gases reached a total of 18,017,347 gallons, an increase of 81.4 per cent over 1929, and nearly 300 per cent greater than marketed during 1928. According to the same authority an approximate segregation of the gases marketed indicates that the 1930 distribution of propane was in the neighborhood of 11,500,000 gallons. The distribution of butanes, pentanes and butane-pentane mixtures used for comparable purposes reached a total of about 6,500,000 gallons, approximately 50 per cent more than during 1929.

(d) Peak Load Control. While the increased consumption of gas in the United States in the past five years has, of course, been very acceptable to the gas companies, it has, at the same time, presented numerous problems, of which one of the most perplexing is peak load control. The storage of gas in holders has enabled the gas companies to operate with an hourly production lower than the maximum hourly plant sendout and, in some cases, with a daily production lower than the maximum daily plant sendout; obviously this latter condition cannot exist more than a few days at the most. The seasonal loads which have arisen, with house heating as the leader, present a dire need for reasonably low cost gas-making equipment which is flexible in its operation and will meet the peak loads with a relatively low cost gas. The carrying charges on equipment used only part time necessitate its being fairly low in cost. Flexibility in operation also is necessary to meet the rapidly rising demands and, at the same time, produce a gas to comply with local requirements and burn satisfactorily without necessitating readjustment of appliances.

The low cost of butane storage and the necessary mixing equipment, coupled with the low fuel cost, makes a butane installation an ideal one for meeting peak loads. In addition to the advantages of low investment and fuel costs, the operating advantages to be secured with butane are highly desirable, inasmuch as the equipment may be put in operation on very short notice and a wide range of control is possible. Since 1928 the Louisville Gas and Electric Company has successfully used butane for meeting peak loads and as a reserve in event its supply of natural gas should fail. That several large eastern and middle-western utility companies are at present seriously considering the use of butane in similar capacities seems to be conclusive proof that it will be used extensively in the near future for many peak load and stand-by requirements.



NEW AND IMPROVED IMPERIAL SUCKER ROD ELEVATOR

Holds fast until operator releases latch with slight finger pull. Body made in one piece and is reversible. Perfectly balanced, light in weight, but strong enough for heaviest strings. Lasts long; no clogging or jamming. One size for ⅝" and ¾" rods; one for ¾" and ⅞". Ask for Folder 433.

"OILWELL" SAFETY SUCKER ROD HOOK

Stabs easily and locks automatically. Hand pressure only opens latch. Guard protects hand from injury. Light, balanced, enduring. No projections to catch on derrick. Timken bearings. Carbo-manganese steel, heat-treated. 17,500 and 22,000-pound capacities. Ask for Folder 431.

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Branch Stores in All Oil Fields

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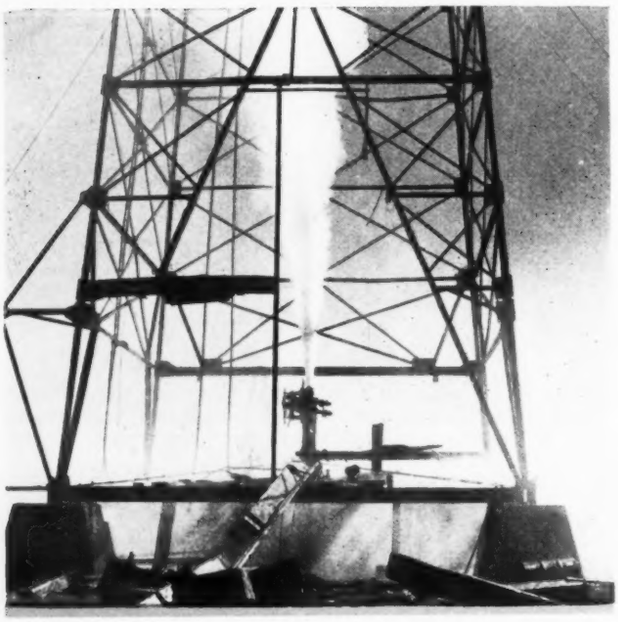


University 4-B well while on the rampage.

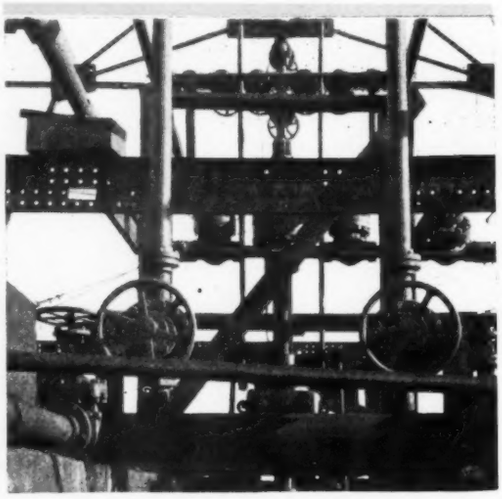
BIG LAKE Well Blowout *Handled Skillfully*

By
K. C. SCLATER

WHEN the Group No. 1 Oil Corporation's well University 4-B, Big Lake field, Texas, blew out at six o'clock on the evening of March 10, it presented a ticklish problem calling for clear thinking and decisive action. Just three hours after the well had been changed over from casing to tubing flow there was a hiss and roar of escaping gas and oil from the cellar. An examination disclosed that the tremendous flow was coming from two 2-inch valves on the side outlet connections of the 7-inch by 9-inch bradenhead in the cellar. What really happened was that the 7-inch casing had, for some cause yet undetermined, either sprung a leak or parted some distance down in the well and, as the two valves on the 7-inch by 9-inch bradenhead had been left partly open, presumably to prevent the pressure from building up between the casings, the well started to flow violently behind the 7-inch string.

Completed at a total depth of 8,587 feet, the well was placed on production January 16, 1931. The 9-inch casing is cemented at 5,500 feet with 2,400 sacks cement, and the 7-inch with 900 sacks at 8,030 feet. It is estimated the top of the cement behind the 7-inch casing is at 3,500 feet. Since there is no evidence of mud having been ejected with the oil and gas through the cellar connections, the leak or break is thought to be above 3,500 feet. Comparison of the pressure observations on the 7-inch and 9-inch casings indicates that the leak or break is some distance from the surface.

From the time the well was completed until February 5, when tubing was installed, the well had produced through the casing under an average pressure of 600 pounds at the casinghead. Throughout this period of casing flow the production gradually increased from an initial of 5,400 barrels oil and 43½ million cubic feet gas to a peak of 8,800 barrels oil and 66 million cubic feet gas daily. As the rate of oil production increase during this period was greater than the rate of gas production increase, the gas-oil ratio diminished from an initial of 12,400 to a minimum of 7,600 cubic feet per barrel.



Close-up taken after well had been capped.

It was desired to reduce the gas-oil ratio and a string of 3-inch tubing was run in the well to 8,550 feet, or 37 feet off bottom. It was installed between the dates February 5 and 10, by the Otis tubing method, while the well continued to produce.

Two tests were made on tubing flow after installation of the tubing, one of nine hours and another of fourteen hours duration. Both results showed, if anything, a higher gas-oil ratio than when producing through the casing. From about February 15 to March 10 the well was produced through the annular space between the tubing and the 7-inch casing. During this period the average flowing pressure in the casing was 1,000 pounds and in the tubing a static pressure of 1,800 pounds per square inch.

When the well was changed over to tubing flow on the afternoon of March 10, every precaution was taken to prevent violent pressure fluctuations in the well. The flow through the tubing was started and gradually increased, while the flow through the casing was gradually shut off. Two hours were taken to make the change. After the change the tubing pressure was adjusted to 800 pounds in order not to exceed a flow velocity of 100 feet per second in the tubing. At this rate of flow the static pressure in the casing was 2,050 pounds per square inch.

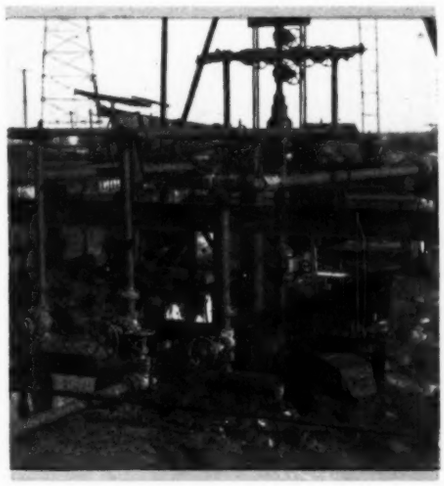
It was just three hours after this change was made that the well blew out between the 7-inch and 9-inch casing.

Immediate access to the cellar was almost impossible because of the gas. All the flow lines on the Christmas tree were opened up in order to cut down, if possible, the flow in the cellar. The upper valve on the tubing was also opened up wide. Even this had little effect on the flow from the cellar connections, so a connection on one of the flow lines was taken apart and the flow diverted from the separator to the atmosphere. In doing this the 4-inch valve on the casing flow line was found to be damaged and could not be closed. An effort to get a shut-off between the tubing and the casing by closing the blow-out preventer at the base of the Christmas tree proved futile. This made the situation critical, as the flow through the open casing flow line was estimated at the rate of 40 million cubic feet daily and there was no way of

shutting off the flow unless by installing a new valve on the flow line.

Getting their heads together, the crew on the well, with E. H. Griswold, production engineer; John Nichlos, assistant general superintendent, Texas division, Continental Oil Company; "Bill" Beyhan, superintendent, and Orville Fisher, farm boss of Group No. 1 Oil Corporation, devised a means of installing a new valve.

A joint of pipe was inserted in the damaged connection on the Christmas tree. Fortunately, it was possible to get the end of the joint of 3-inch pipe through the body of the damaged valve. To force the end of the three-inch joint into the damaged connection against the gas flow, two anchor clamps were attached to the 3-inch pipe, one near the middle and the other near the outer end. Lines were attached to the inner clamp and strung through snatch blocks snubbed to the derrick. A team of mules, one to each line, pulled the pipe into the connection against the gas pressure. Lines attached to the outer clamp were handled by members of the crew, who stabbed the 3-inch pipe into the connection on the Christmas tree and also kept the pipe from being whipped about by the gas flow.



General view of well-head connections after well was under control.

When the 3-inch pipe was in place it diverted most of the gas flow outside and away from the derrick, thus making it possible for the crew to unscrew the connections. All connections on the open casing flow line up to a nipple in the body of the damaged valve were unscrewed and slid along the 3-inch joint. By removing the pipe from the body of the valve the old connections were slipped off and a new valve slipped on. Once more the 3-inch was snubbed into the body of the damaged valve, after which it was a comparatively easy job to screw the new 4-inch valve onto the nipple in the old valve body. When this was done the Christmas tree connections were once more secure. This took about two days, and on the third day attention was again directed to the cellar connections. Meanwhile two jets and a stem pump had been set to work to keep the oil pumped down in the cellar, but they were woefully inadequate to cope with the flow, which was estimated at 2,500 barrels oil and 20 million feet of gas per day.

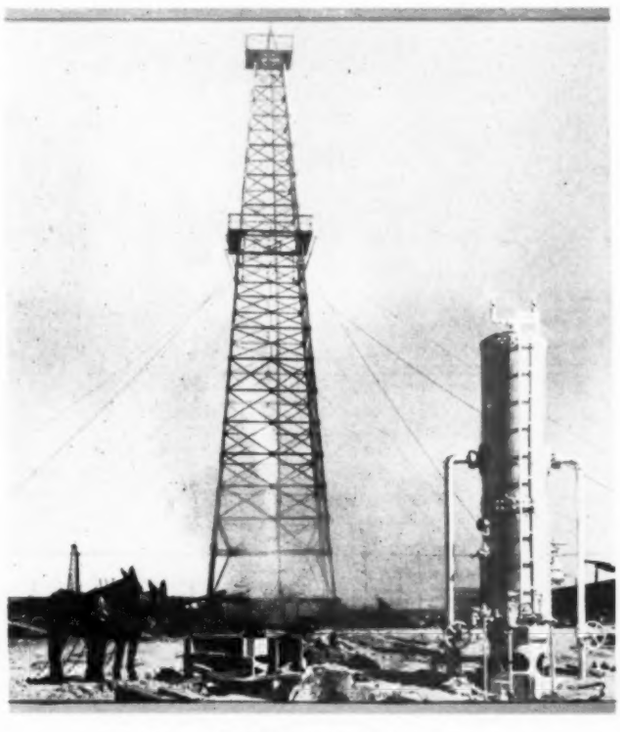
As it was impossible to work in the cellar while the gas was blowing, the valves on the bradenhead were finally closed from the derrick floor by means of an extension handle. When closed the valves on the bradenhead leaked badly and it was decided to replace them, as they had to hold the well pressure behind the 7-inch casing until such time as the necessary preparations could be made to repair the casing.

Changing these valves was another difficult problem. The job was rendered more difficult because of the confined cellar space. Each connection on the bradenhead consisted of a 3-inch by 2-inch swage—the 3-inch end screwed into the bradenhead—a 2-inch coupling, a 2-inch nipple, and the valve. Between the wall of the cellar and the valve the distance was only 33 inches. In the walls of the cellar opposite the valves two large holes were found. The streams of gas and oil had almost bored their way through the wall of concrete eight inches thick and a lining of timber two inches thick. These holes were filled with lead wool and the valves covered with a heavy wrapping of burlap. This precaution was taken to reduce the hazard of sparking in case the valves shattered or were blown off during removal

An ingenious method of replacing the valves was worked out. A set of connections similar to those on the bradenhead were made up in the field warehouse and a device to plug the connection while replacing the valve was devised. No success was had with the first one tried, so another device slightly different in design was made. This proved highly successful. It consisted of a solid steel stem, about 30 inches long and 1¼ inches diameter, on one end of which a plug was mounted. The plug was made from four 2-inch pump cups with their lips pointed downstream and packed inside with lead wool. The outside of the stem was threaded to fit a nut attached to a short 2-inch nipple. A handle was attached to the outer end of the stem. With the valve closed the nipple was screwed into the valve body, then the valve was opened, the plug forced through the valve body and firmly seated in the swage by turning the handle of the stem. When the plug was securely in place a screw-jack was inserted between the end of the stem and the cellar wall to hold the plug in place.

After the old valve was unscrewed and moved toward the outer end of the stem a clamp was attached to the other end of the stem close by the plug. This clamp butted against a nut rigidly attached to the stem. A line attached to the ends of the clamp and lashed securely around the bradenhead held the plug in place while the screw-jack was removed, the old valve slipped off the stem, the new valve slipped on, and the screw-jack replaced and tightened against the end of the stem. The clamp was then removed and the new valve screwed into place.

The valve on the other side of the bradenhead was similarly replaced.

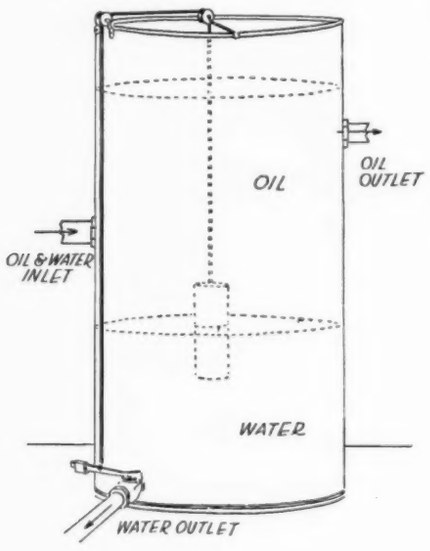


University 4-B well just after it had blown out.

TIME *and* TROUBLE SAVERS

Differential Float for Automatically Bleeding Lease Tank

MANY wells in the Darst Creek field, South Texas, produce large quantities of water with the oil. Fortunately separation of the water and oil is not difficult. This is accomplished automatically on many leases by the use of a differential float which maintains the oil-water level practically constant and, at the same time, bleeds the water from the tank.



Before installing the float, which is of light steel construction and cylindrical in shape, it is partially filled with liquid, usually oil or water, and sealed. It is so weighted that it will sink in oil of the average gravity and float in water. As shown in the accompanying sketch, the float is connected by a flexible cable to a valve on the bleeder line outside the tank. As the float rises or falls, it opens or closes the valve on the bleeder line, thus maintaining the water in the tank at any desired level and at the same time controlling the oil level. This arrangement is found to work admirably.

Water Percentage Chart

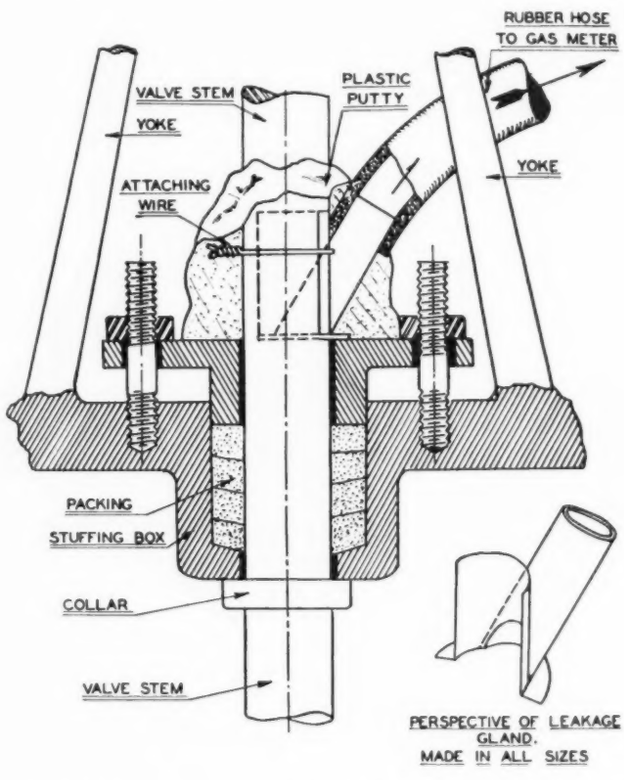
FIELD men of the Carter Oil Company in the Seminole district need not guess nor resort to mathematics to determine the ratio of water (barrels) contained in cut oil. This information has been printed in tabular form and is supplied to each man who tests producing wells for cut oil. After ascertaining the percentage of cut it is only necessary to refer to a chart of percentages up to 99 and barrels of oil up to 1,000. The answer to the ratio of water is found by tracing the cut percentage to the amount of barrels of oil produced by the well. An example: A well producing 100 barrels of pipe line oil is cutting 30 per cent according to centrifuge test of a fluid sample. Then the number of barrels of water produced with the oil is 42.8.

Siren on Motors

A siren tied in to distant electric motors, so that it will blow when the motor stops, saves expensive supervision and many steps for the operator.

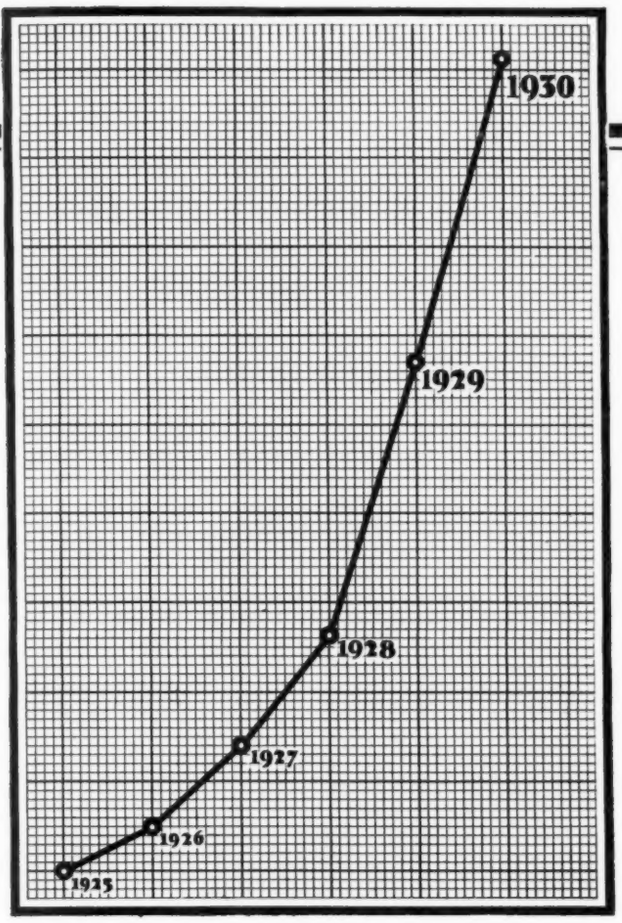
Determining the Volume of Leakage at Valve Stem

TO determine the volume of leakage around a valve stem, Hal. T. Wheeler of the Q-P Packing Corp., Tulsa, Okla., designed the device shown in the accompanying illustration. A sheet metal leakage gland is made to fit half the surface of the valve stem. In height, it is about one and one-half times the stem diameter. A discharge opening is provided at the junction point of a tube fastened to the gland. The gland is wired to the stem just above



the packing gland and all the joints are packed tight with a plastic compound. A one-inch rubber hose is used to connect the tube on the leakage gland with a gas meter. If the valve leaks around the stuffing box, wedge a straight piece of pipe, flattened on the inserted end, between the packing gland and the valve body, and then measure with the described method.

THERE is little trouble encountered from paraffin in producing wells of the Seminole district, but occasionally it is necessary that the small accumulation of paraffin be cleaned out. The Carter Oil Company, for this purpose, pumps from 2,000 to 15,000 gallons of gasoline into the well and lets it set for three or four hours, during which time it cuts the paraffin from the walls.



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No. 1 HIGH TEST WELDING ROD

STRENGTH

Oxweld No. 1 High Test Welding Rod makes welds 20 per cent stronger than mild steel rod.

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Rigid manufacturing standards and careful tests insure uniform performance.

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Self-fluxing and deoxidizing, it fuses quickly and permits faster, easier work.

ECONOMY

Because it is time-saving, it cuts labor costs and reduces gas consumption to a minimum.

Every year the Backbone of More and More Welds

The phenomenal year by year rise in the demand for Oxweld No. 1 High Test Welding Rod indicates its unusual acceptance by Engineering and Industry.

Experienced welders know that probably no other factor plays a more important part than the right welding rod. That is why more jobs were done with Oxweld No. 1 High Test Welding Rod in 1930 than in 1929... and why in 1929 this same rod became the backbone of more welds than in the previous four years combined! Oxweld No. 1 H. T. Rod has all the qualities demanded of a high test rod.

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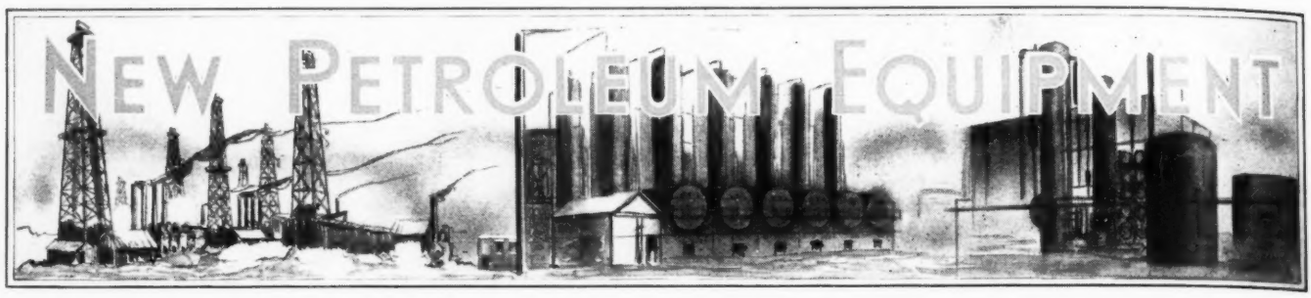


Three New Nikeladium Steels

THE Los Angeles Steel Casting Co., Ltd., 2444 South Alameda Street, Los Angeles, Calif., manufacturers of Nikeladium, a special alloy steel, has announced three new "partner" steels of Nikeladium, known as A1 20, A1 30 and A1 40. The new partners of Nikeladium are three high-grade steels designed to present various combinations of strength and toughness that can be made to fit special conditions of service. Additional information on these, as well as Nikeladium, may be obtained by writing the Los Angeles Steel Casting Company.

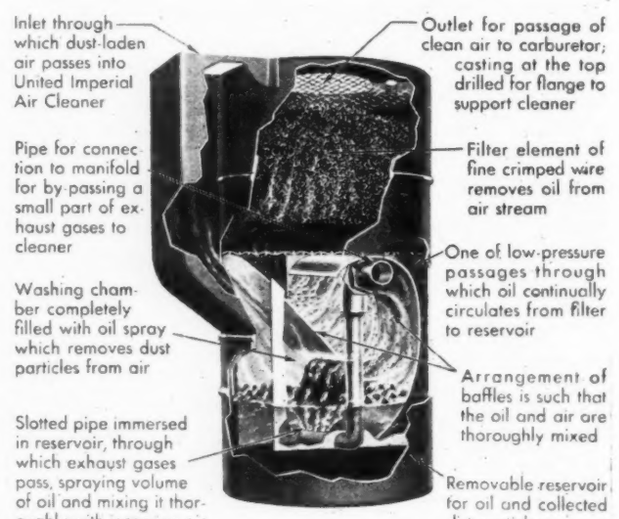
Papico H. & K. Odorizing Equipment

THE Pacific Pipe & Supply Company of Los Angeles has recently placed on the market the Papico H. & K. natural gas odorizing apparatus.

The method of odorization consists of the automatic injection of odorant fluid into the gasoline by means of the differential pressure obtained across an orifice plate. The apparatus is used in conjunction with the standard orifice meter installation. Equipment consists essentially of a storage tank, float valve, chamber, strainers, sight feed, calibrating tube, odorant orifice and necessary valves and fittings.

The amount of odorant introduced into the line is proportional to the volume of gas flowing. Control of the odorant fluid is obtained by varying the orifice size of the discs in the main line and in the odorant line.

Complete information on the equipment may be had from the Pacific Pipe & Supply Co., Los Angeles, Calif.


Inlet through which dust-laden air passes into United Imperial Air Cleaner
Outlet for passage of clean air to carburetor; casting at the top drilled for flange to support cleaner
Pipe for connection to manifold for by-passing a small part of exhaust gases to cleaner
Filter element of fine crimped wire removes oil from air stream
One of low-pressure passages through which oil continually circulates from filter to reservoir
Washing chamber completely filled with oil spray which removes dust particles from air
Arrangement of baffles is such that the oil and air are thoroughly mixed
Slotted pipe immersed in reservoir, through which exhaust gases pass, spraying volume of oil and mixing it thoroughly with incoming air
Removable reservoir for oil and collected dirt particles

Oil-Type Air Cleaner

UTILIZATION of exhaust gases as a means of operation is a new feature incorporated in the United Imperial air cleaner recently developed by the United Air Cleaner Corporation, 9705 Cottage Grove Ave., Chicago, Ill., and designed especially for the protection of internal-combustion engines used on tractors, trucks, excavators, compressors and other engine-driven equipment exposed to severe dust and dirt conditions.

The new cleaner is of the oil type, a removable compartment at the bottom being provided for the oil reservoir. Immersed in the oil is a short section of slotted pipe which is connected to a tap on the manifold, so that a small amount of the exhaust gases is by-passed to the cleaner. As soon as the engine is started, the heated gases emitted through the slot cause turbulence in the oil, with the result that the washing chamber immediately above the reservoir is completely filled with an oil spray. Outside air admitted to this chamber must pass through the spray and be deflected by a series of specially-shaped baffles, the combined action of the oil spray and the baffles resulting in washing the air thoroughly and removing the dust particles. The oil-laden air then passes through a filter compartment packed with fine crimped wire, which removes the oil and completes the cleaning process.

Armstrong Compound Steam Trap

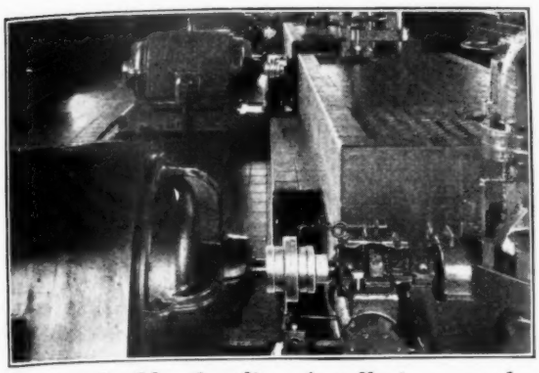
ARMSTRONG Machine Works, of Three Rivers, Mich., has developed the new Armstrong compound steam trap for handling large quantities of water. It has few moving parts, is simple in design, and has high capacity for a given diameter of discharge orifice, the manufacturer states.

Design and construction are such that little attention is required, but should it ever become necessary to inspect the operating mechanism, all parts are easily accessible without disturbing the inlet or outlet connections.

The body of the compound trap consists of standard Armstrong trap bodies bolted to a piston housing. In the No. 230 series compound traps, for pressures up to 250 pounds, the piston housing and bodies are made of close-grained semi-steel of high tensile strength and containing nickel and chromium. For high-temperature, high-pressure duty, the bodies are one-piece forged, while the piston housing is machined from a solid steel billet.

Full description of this new trap may be secured from the Armstrong Machine Works.

Coupling Replacements Banished



Fast's Flexible Coupling installations at the Main Pumping Station of the Pure Van Pipe Line Company, Van, Texas.

-- *no Flexible Pins or Springs*
-- *no Perishable Felt Washers*

FAST'S MECHANICAL FLEXIBILITY

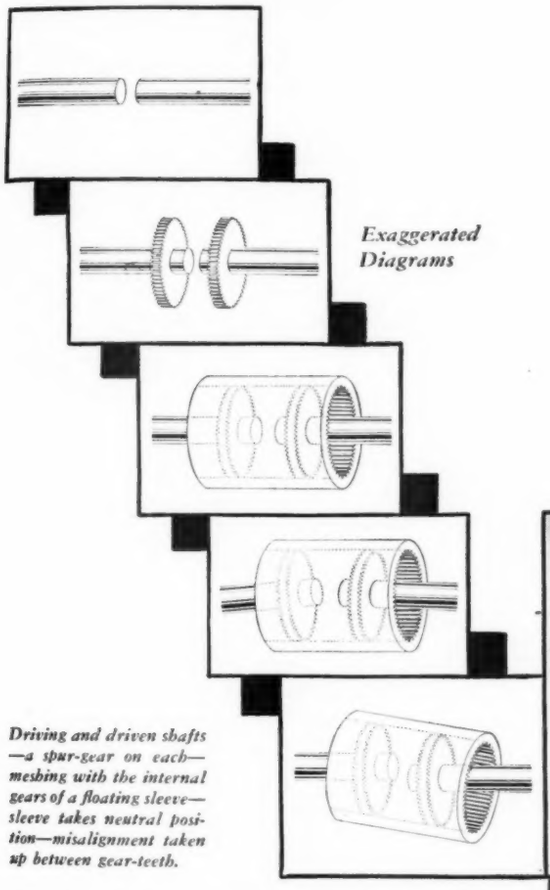
THE diagrams tell the story. Instead of depending upon flexible materials for flexibility, all forms of shaft misalignment are compensated for between the lubricated faces of the gear teeth.

And better still, Fast's Coupling is "double-engagement." Misalignment is divided between two sets of gear teeth, the center sleeve taking a neutral position. *Only* by "double engagement" can *all forms* of misalignment be taken care of without damaging stresses and crank-action in the connected shafts and bearings.

PERMANENTLY DUST PROOF

Oil carries the load between the gear teeth, due to capillary and centrifugal action produced in rotation. And this oil is permanently clean and free from moisture, dust, and grit. All-metal *bearing rings* seal the sleeve. No washers, no makeshifts. Permanent and definite seal makes Fast's Coupling (when oiled like any other equipment) last as long as connected machines.

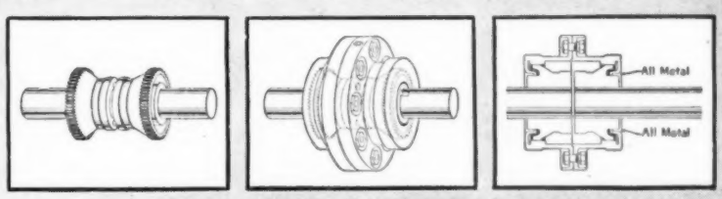
Fill in and mail the coupon below. It will bring you the new bound catalog of Fast's Self-Aligning Couplings and their application to your problem.



Exaggerated Diagrams

Driving and driven shafts —a spur-gear on each— meshing with the internal gears of a floating sleeve— sleeve takes neutral position—misalignment taken up between gear-teeth.

Dust-Proof - - And Stays Dust-Proof



Two hubs carry generated gears. *Internal teeth of sleeve mesh with hub gears.* *All metal bearing-rings permanently exclude dust and grit.*

FAST'S
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NO FLEXIBLE MATERIALS

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Send me free bound copy of Fast's Self Aligning Coupling Catalog showing varieties of designs and installations, and containing valuable data on coupling installation.

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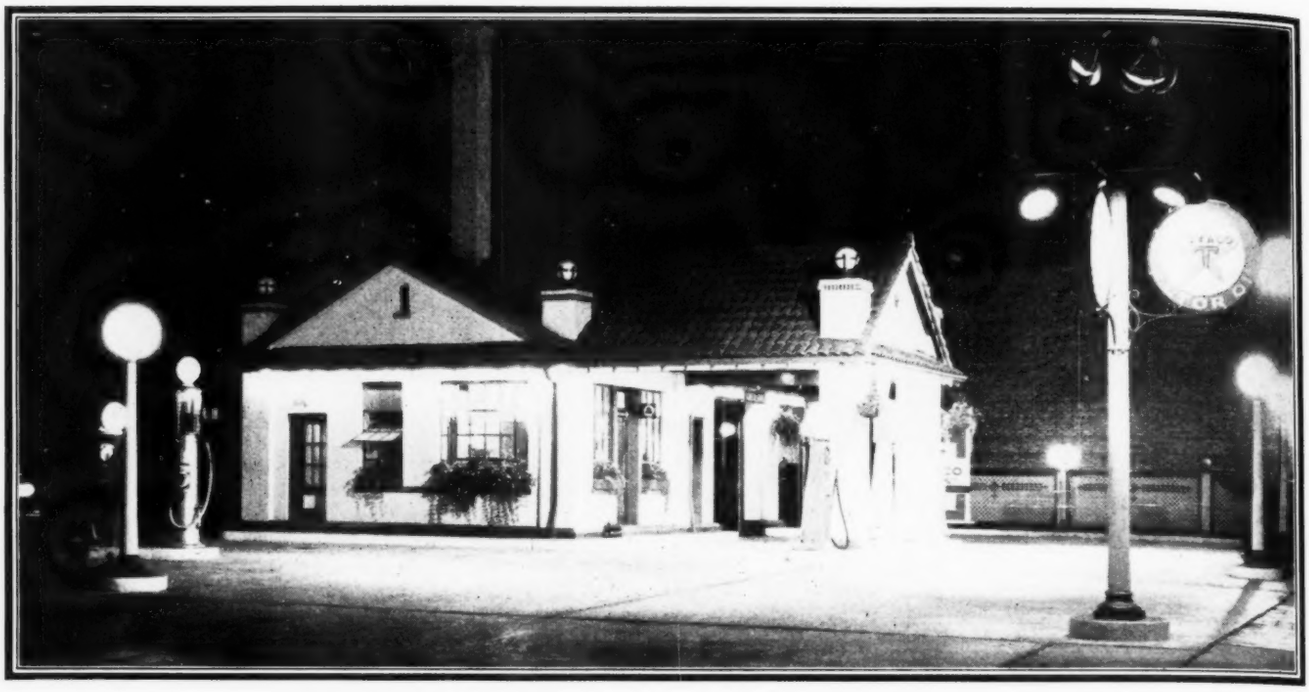
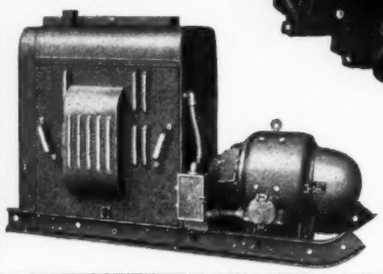


Who wouldn't want to drive in here?

Below. This Vaporproof fixture takes Standard RLM reflector. It is one of the many Pyle-National vaporproof fixtures giving safe lighting in the presence of fumes, gases and moisture.

Pyle-O-Lyte Floodlight Projectors—for efficient, evenly distributed yard illumination.

Below. Type O Direct Gas Electric Plant — constant engine speed regardless of load gives dependable power for lighting equipment.



Above. M-2-S Turbogenerator. Large capacity, heavy duty rig lighting unit. Steady, reliable service with minimum attention.

NOTICE what a "come right in" aspect the Pyle-O-Lyte Floodlights give to the service station illustrated above.

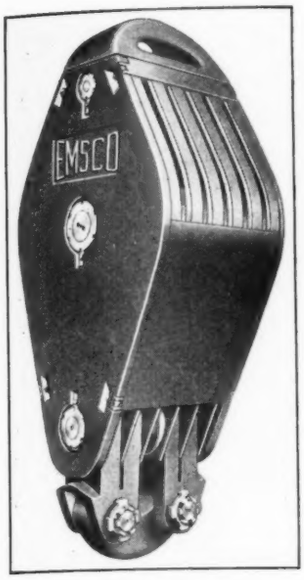
Progressive station operators are profiting by what the chain stores have learned about the drawing power of light. They know that the night driver stops at the station that attracts him most, not necessarily at the one nearest him. Good lighting to him represents good service and quality products.

Pyle-O-Lyte floodlighting costs little in comparison with what it does for your business. These powerful, efficient floodlight projectors put the light where it is needed, without waste. They are built for a lifetime of economical service. Write for bulletin on lighting, with complete description. There is no obligation.

THE PYLE-NATIONAL COMPANY

General Offices and Works: **1334-1358 N. Kostner Avenue, Chicago, Illinois**
Direct Factory Representative: **R. F. Kilker, Exchange National Bank Building, Tulsa, Oklahoma**

Emsco 76-Inch Traveling Block



EMSCO Derrick & Equipment Company, Los Angeles, has announced a new 76-inch roller-bearing traveling block.

The sheaves are made from manganese steel and are 42 inches in diameter, as compared to the 36-inch diameter used in the company's 66-inch traveling block. The rope grooves conform to A. P. I. specifications and are ground to a finish to reduce bending stress and wear on the wire line. The sheaves are enclosed by a steel guard.

Sixteen hardened and ground chrome vanadium steel rollers, ground to a diameter of 1¼ inches, are provided for each sheave. The patented roller-bearing assembly includes a bronze cage of special design to allow the rollers to rotate the entire width of the sheave hub.

The center pin is eight inches in diameter, with Alemite fittings provided at each end of the pin for lubrication of the rollers.

The detachable bottom clevis eliminates the necessity for removing the bottom pin and dropping the entire clevis and spacers out of the block when attaching the swivel bail or other equipment.

The Emsco company will gladly furnish additional information on this new product.

Daniel Orifice Fitting

THE manufacture of the Daniel Orifice Fitting is announced by Daniel & Company, 1900 Santa Fe Avenue, Los Angeles, Calif. This orifice fitting is designed and constructed to offer ease and simplicity of operation.

The shut-off valve is of steel construction and seats on a ground surface with a metal-to-metal contact. The valve is held against the seat by the powerful thrust exerted on the eccentrics which are operated by rods leading through a stuffing box to the outside of the fitting. The line pressure assists in keeping the valve tight; and tests up to 2,000 pounds per square inch have disclosed no signs of leaking, according to the manufacturers.

Full details of this new orifice fitting may be secured by writing to Daniel & Company.

Machine Cleaning in Reconditioning Pipe Lines

THE Dearborn Chemical Company has recently perfected the Dearborn pipe-cleaning machine, Jinnett patent. This device produces superior results, the manufacturer states.

The machine removes the dirt, dust and old coatings, and is so designed as to free itself from the dirt and deposits removed from the pipe. The only requirement for successful operation is that the cutting tools be kept sharp and in proper adjustment. Cutters may be sharpened on an ordinary emery wheel, and a portable outfit is recommended on the job where much cleaning is to be done. One man can easily change the cutters.

The Dearborn pipe-cleaning machine requires about an eight-inch clearance for operation and permits pipe to be cleaned, either when elevated eight inches off the floor of the trench or when removed from the ditch with similar clearance.

The condition of the pipe to be cleaned determines the speed with which the machine is pulled along the line to effect thorough cleaning.

Detailed information, including recommendations, will gladly be submitted by the company, whose address is 310 S. Michigan Ave., Chicago.

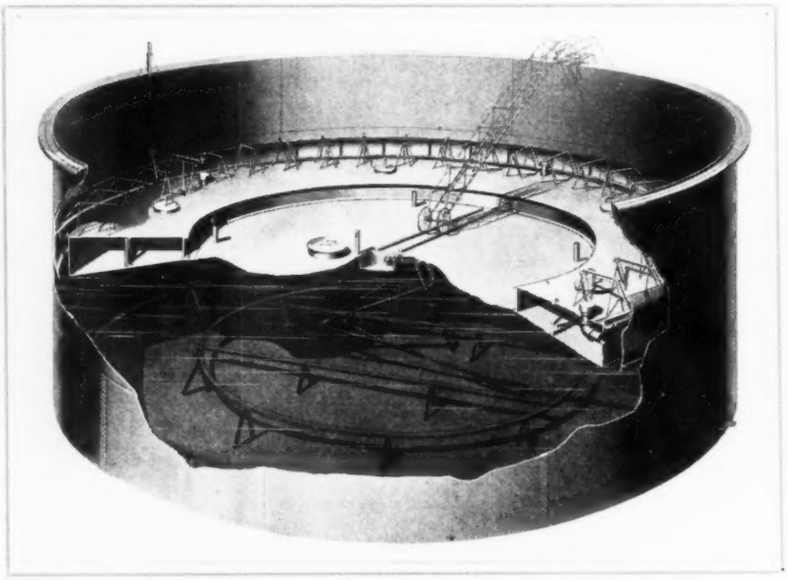
Hard-Facing Materials

A NEW group of hard-facing materials is announced by the Armite Laboratories of Los Angeles. These products cover the entire field of hard-facing application, according to the manufacturers, and consist of compounds, inserts and hard-facing rods.

One of the products is known as Armite Arcweld, which is a tungsten carbide compound in black granular form, applied with an electric arc using a negative carbon electrode. The company also produces this material in tube form, which is said to be the first time tube stock has ever been introduced in this kind of hard-facing.

The laboratory also manufactures diamond-like inserts and compound ranging from as small as 20-mesh to ½-inch diameter. A hard-facing rod is also manufactured by the laboratory and is said to be of lighter weight than any heretofore placed on the market, permitting coverage of more surface for each pound of material. This hard-facing rod is made in three consistencies of hardness and has a melting point of 2300 degrees F. An attractive catalog listing the several Armite products may be procured by addressing the manufacturers, Armite Laboratories, 318 West 9th Street, Los Angeles.

THE Chicago Bridge & Iron Works is now building a new pontoon type of Wiggins floating roof in addition to the regular standard open-deck type made by them for a number of years. The principle of the new design is essentially the same as the open-deck type, except that the pontoon feature has been added.



Pontoon Type of Wiggins Floating Roof

The outer edge of the deck is built in the form of a continuous annular pontoon. This continuous section is divided at regular intervals by bulkheads which form water-tight compartments. The sections, each of which acts as an individual pontoon, make the deck practically non-sinkable.

The principal advantage of the pontoon construction is that it provides insulation for the roof where insulation is most valuable — at the seal which closes the space between the deck and the tank shell. Temperature readings on installations show that the temperature throughout the depth of the seal is relatively uniform and materially lower at the hottest part of the day than if the insulation were not provided.

The new design uses the standard Wiggins seal, which consists of a ring of shoes that forms a long, sliding contact with the tank shell. The shoes are joined to the deck with a flexible material which allows the seal to expand or contract, taking care of the irregularities on the inside of the tank shell or any slight variation from shape of the tank shell.

The new Wiggins pontoon roof is designed particularly for use on tanks storing light oils at locations where high temperatures are encountered.

Flexi-Unit Line by Goulds

TWENTY-FOUR-HOUR shipment of complete centrifugal pumps, either from the factory, their branch warehouses or from a distributor is promised by Goulds Pumps, Incorporated, Seneca Falls, New York, on its new Flexi-Unit line, just placed on the market.

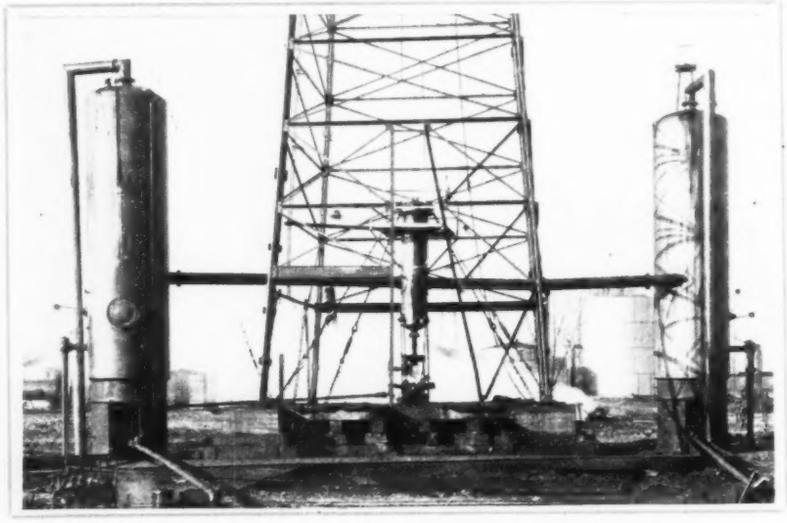
The Flexi-Unit centrifugals comprise eleven standard pump units, with changeable impellers, and nine universal bedplates for mounting any size motor from one-quarter to fifty horsepower and with speeds of from 1450 to 3450 revolutions per minute. From this limited stock of parts 150 pumping combinations can be produced for capacities from 10 to 1100 gallons per hour, at heads of 350 feet.

Each Flexi-Unit is of high quality in design and construction.

B. S. & B. Cushion Drum

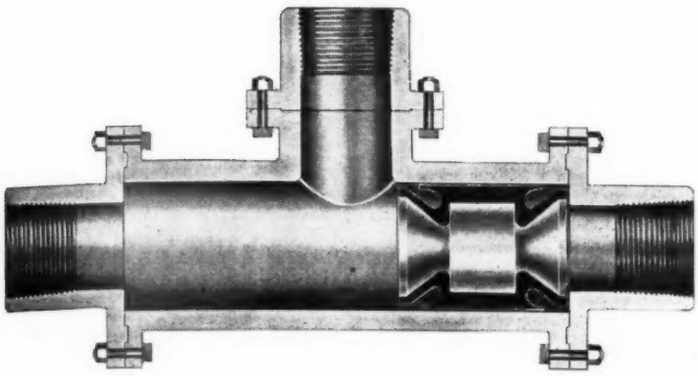
THE B. S. & B. cushion drum has been developed by the engineering department of Black, Sivalls & Bryson, Inc., of Bartlesville, Okla., of which the American Tank & Equipment Company, Oklahoma City, manufacturers of American separators, is a subsidiary company. It was produced for use with the improved American oil and gas separator to take care of the severe conditions under which the companies are operating at Oklahoma City.

The cushion drum, which is 30 inches by 15 feet, sets immediately over the wellhead. It is anchored to the casing and the derrick. The purpose of the cushion drum is to eliminate the risk of permitting a well to get out of control. These wells produce a big volume and most of them make a large amount of sand along with the oil and gas. The high velocity of the flow of oil and gas, together with the sand, often results in cutting equipment.



The B. S. & B. cushion drum is designed so that a choke of any size can be inserted quickly. These chokes are furnished by Black, Sivalls & Bryson in various sizes from one-half inch diameter to 4 inches diameter. The oil, gas and sand flow from the cushion drum into the specially designed separator, from which the sand is taken out in the cone botton.

The large volume of gas is taken out of the top of the separator through the gas outlet.

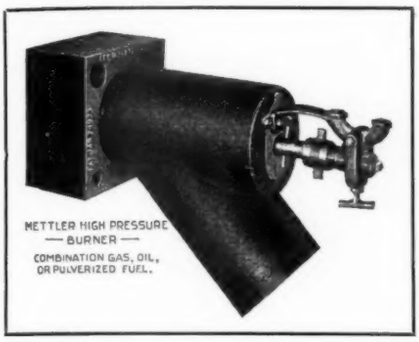


Brauer Manifold Valve

THE Brauer Machine & Supply Company of Oklahoma City is manufacturing an improved type manifold valve in addition to their regular line of valves.

The features of this are the new double cup plunger and flat face valve seats, which eliminate trouble with the plunger sticking. The plunger is of molded rubber around a steel core, permitting a metal-to-metal seat with a rubber seal against a flat-face valve seat. The fluid pressure exerted against the plunger cup also makes a seal against the cylindrical bore of the valve and prevents sand working around the plunger, causing it to stick. Particulars can be had by writing Brauer.

High-Pressure Water-Cooled Burner



ADAPTABLE to a wide range of uses in the industrial field, the high-pressure water-cooled gas burner now being manufactured by the Lee B. Mettler Co., 406 S. Main St., Los Angeles, Calif., is made in a number of sizes and capacities and for burning gas, oil, or pulverized coal, separately or in combination.

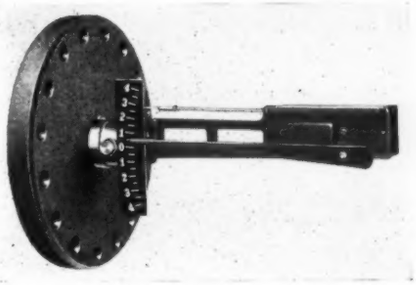
The burner proper is made of heat and corrosion-resisting material, and is arranged for water-cooling. Gas is supplied to the burner through a single inlet pipe and delivered from a number of orifices placed around the circumference of an annular gas chamber. This gas chamber is completely surrounded by a water-cooling space of ample proportion and so made that the outside of the burner is square.

The burner is offered in three sizes for 8, 6 or 3-inch pressure air or pulverized fuel connections. The gas inlets are 2, 1½ and 1-inch, the water connections 1, ¾ and ½-inch, respectively.

Each size of burner can be had with three sizes of gas orifice, $\frac{7}{16}$, ¼ and ⅛-inch, and with eight, six and four nozzles per burner. Capacities range from 160 to 24,000 cu. ft. of 1,000 B.t.u. gas per hour.

Tagliabue Level Indicator

AN improved level indicator is announced by the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y.



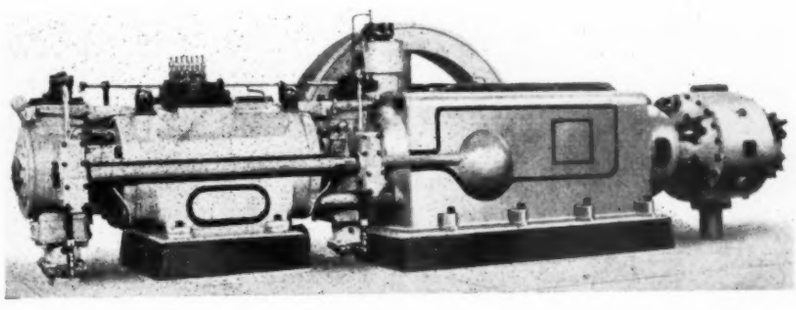
This incorporates electric contacts for operating signal lights in the control house and sealed mercury contacts for the plant. These contacts are kept at a certain distance from the flange face, so as not to be affected or destroyed by high temperature at the flange.

The tilt switch holding the mercury bottle is pivoted on the end of a bracket so that it is more than a foot away from the flange. The movement of the float, after being suitably reduced, operates a rocker-arm on the spindle and the motion of the rocker-arm is communicated to the mercury tilt switch by a long connecting link or rod. This same motion also revolves a spindle which ends in a long, red pointer, causing it to move across the scale, which has white figures and graduations on a black background.

Further details on this new level indicator may be obtained from the company.

Four-Cycle Compressor Unit

THE new Type 40 four-cycle compressor unit recently announced by The Cooper-Bessemer Corporation, Mt. Vernon, Ohio, seems to have achieved unusual compactness in its design. It delivers 400 brake horsepower in about the same space usually required for 200 B. H. P., the manufacturers state.

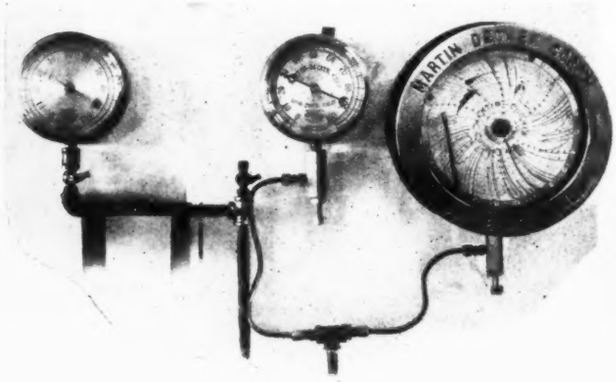


Reports on installations of these new twin units indicate that operators approve of the unusually low build and other features of the design, making all moving parts easily accessible. Consequently, adjustments and replacements can be made quickly.

Information on specifications and performance may be obtained from the manufacturers.

Utility Model Pulsation Dampener

THE Martin-Decker Corporation, Long Beach, Calif., has designed the adjustable pulsation dampener used on its mud pump gauge in a "Utility" model adapted for throttling the pulsations of compressors and pumps of all types. Due to its adjustable feature this device may be used either for a few inches of water or for 2000-pound gauge pressure. While damping out all vibration, there



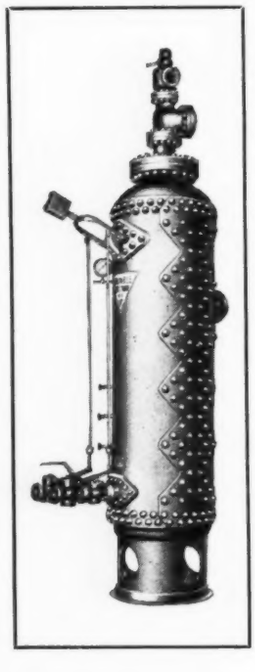
is no appreciable time lag. It is immediately sensitive to either large or small changes in pressure and the gauge always indicates the true mean pressure, the manufacturer states. It is easily cleaned without disturbing connections.

Gauges and recorders protected with this device will last as long as if on constant pressure, according to the manufacturers, besides giving an accurately readable indication and record.

It is equally adaptable to low-pressure manometers, U-tube and draft gauges, orifice meters and many other types of pressure instruments.

Additional information will be furnished by the manufacturer upon request.

Kettleman Type Separator



THE Trumble Gas Trap Company, Los Angeles, Calif., has recently designed a new separator known as the Kettleman Type. This separator is the outgrowth of continued research and experimental work, both at the Trumble factory and in the fields. It further amplifies the original Trumble principle of spreading the oil on the walls of the separator in a thin film by the addition of a greater surface on which the gas can impinge.

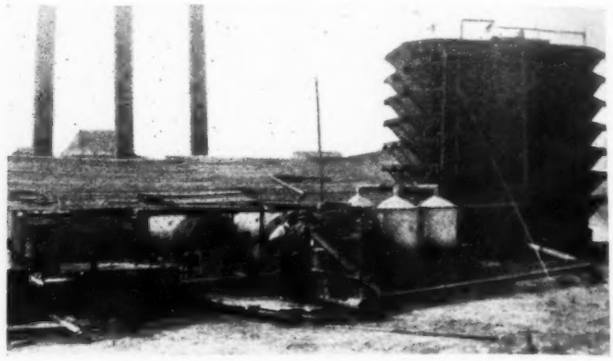
The gas capacity of the separator has been increased in excess of 40 per cent in the new Kettleman Type.

The Trumble Gas Trap Company will gladly supply anyone interested with specifications and other information relating to these traps.

Anderson Engineer Company Organized

M. GESSEL of Tulsa, Okla., announces the incorporation of the Anderson Engineering Company for the purpose of manufacturing and marketing of condensers, heat exchangers and cooling towers.

Development of this equipment has been carried on the past two years. It has been built and tested for steam condensing in connection with drilling rigs in the Oklahoma City field. The object of these tests was to prove the practicability of the Anderson design of condenser and cooling



Anderson-type refinery equipment.

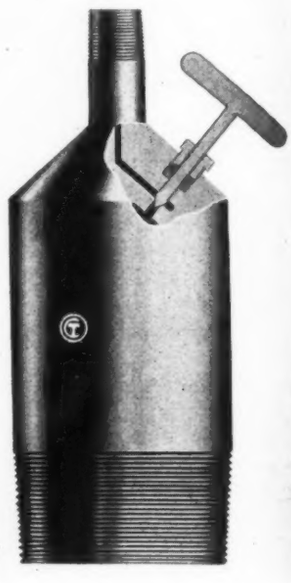
tower in the work of saving water in the drilling of wells along with the benefits derived in the operation of boilers by the use of distilled boiler feed water afforded.

Full description of this type condenser and other products of the Anderson Engineering Company may be secured by writing the general offices at the Morris Plan Bank Building, Tulsa, Okla.

The OCT Pressure Gauge Relief Nipple

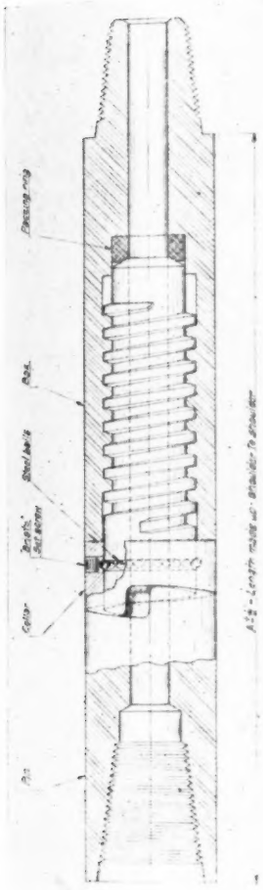
PRESSURE gauge relief nipple designed to eliminate pulsation of gauges installed on fluid lines or fluid-handling equipment where pressure changes are rapid and considerable in range is being marketed by the Oil Center Tool Company, Inc., 924 Adelle Street, Houston, Texas.

The unit is so constructed that pressure changes are recorded quickly, but with steady movement of indicator hands. Gauges equipped with these nipples cannot jerk or wigwag, an action detrimental to even the finest gauge equipment. The nipple cannot freeze and works perfectly in any weather, the manufacturer claims. A needle valve is built in the top of the nipple to permit changing gauges without shutting a gate valve between the fluid line and the nipple. The needle valve is tight under all pressures and permits gauge changes without danger.



Further particulars on the OCT pressure gauge relief nipple may be secured from the manufacturers.

New Spiral Type Drilling Joint



THE Baash Ross Tool Company of Los Angeles, Calif., has placed on the market a new spiral type drilling safety joint that provides a positive release under all drilling conditions. This new safety joint with its three-to-one release safety factor eliminates the danger of freezing long strings of drill pipe.

The joint is composed of three essential parts, namely: The pin, box and collar. The collar comes as a unit, with the pin end being held in place with steel retainer balls. The shoulder between the pin and collar is a spiral, having a direction opposite to that of the tool joint thread. It also has a lead several times as great as the thread. The faces of the collar and box are of hardened steel and are provided with an arrangement of driving shoulders which causes them to turn in unison. A rubber packing ring is provided to prevent circulating fluid from working into the threads.

In operation, as long as the rotation is in the direction of the tool joint thread the joint is locked firmly together, due to the wedging action of the collar and seating of the driving shoulders of the ring. As soon as the direction of rotation is reversed the collar immediately backs off on the spiral, causing the joint to break at the shoulders at this point.

Cardwell Allsteel DA-30 Air Hoist Unit

THE Allsteel Products Manufacturing Company, Wichita, Kan., has developed and placed on the market the new Cardwell Allsteel DA-30 air hoist combination unit, designed particularly for use on pipe lines.

This unit consists of the same frame and live-boom used in other Cardwell Allsteel pipe line winches. It also includes a Davey air compressor and tank, and Little Giant two-and-one-half-ton air hoist. Elevation and angle of live-boom is hand-controlled from operator's seat. The unit is designed for mounting on a tractor.

The air hoist is instantly available to handle, load or unload pipe. The compressor supplies air pressure for operating brushes for cleaning pipe; to spray priming coat and for blow-torches used in making hot bends in larger sizes of pipe. The unit is so designed that it permits unhampered use of the drawbar, thereby rendering the tractor available for hauling distillate tank, or "dope wagon," and a sled or trailer to carry loose equipment used in bending, spraying or cleaning pipe.

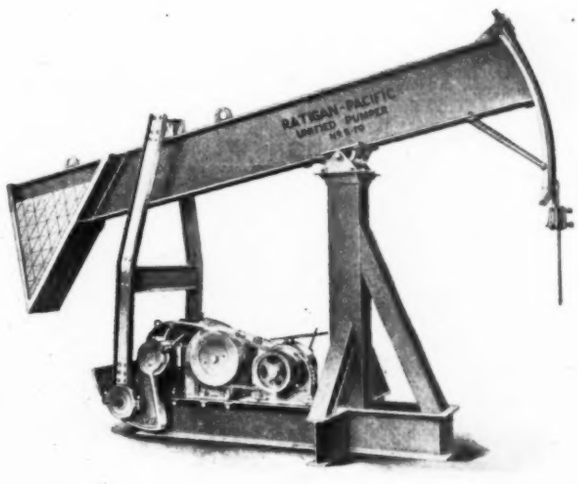
Ratigan-Pacific No. 5-Fo Unified Pumper

MANY distinctive and exclusive features are claimed by J. P. Ratigan, Los Angeles, Calif., for the new No. 5-Fo Unified Pumper.

This new pumping unit may be operated by electric, internal combustion or countershaft drive. It is constructed of extra heavy, reinforced, welded structural work throughout with no bolts or rivets. The speed reducer and wrist pins have heavy duty roller bearings. The pump has an enclosed oil bath universal joint type bronze pitman stirrup bearing, and is equipped with a straight lift horsehead-type beam hanger, complete with polished rod grip, and a combination centrifugal and dead weight counterbalancing system.

Stroke speeds of the unit are from five to 24 per minute with a stroke range of 24, 32, 40 and 48; or 48, 50, 64 and 72 inches. The manufacturer states that it will pump at 6,000-foot depths without overload.

Complete details and specifications will be sent by J. P. Ratigan on request.



Charles P. Dimit, formerly vice-president in charge of production for the Independent Oil & Gas Company, has been made general superintendent for the Phillips Petroleum Company, with which the Independent was merged. Mr. Dimit, although a young man, has a wide experience in the producing end of the oil business. For a number of years he was general superintendent for the Gypsy Oil Company. Mr. Dimit has moved to Bartlesville and will be greatly missed by his friends in Tulsa, where he resided for many years.

Charles P. Dimit

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Donald E. Dickey has joined the engineering department of Broderick & Bascom Rope Co. He will devote much of his time to the California oil fields. Mr. Dickey is well known to the oil industry, having been the assistant engineer of tests for the General Petroleum Corporation; also formerly national secretary of the A. P. I. Standardization committee on wire rope and cordage.

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H. S. Lindenmuth

H. S. Lindenmuth will represent the Lucey Products Company in the East Texas oil fields. He will make his headquarters at the company's Kilgore store.

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George E. Longfellow, formerly district superintendent, Skelly Oil Company, Shidler, Oklahoma, is now general manager of the Winifrede Company at Charleston, West Virginia.

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William C. Whaley, formerly assistant general superintendent, Barnsdall Oil Co. of California, has been appointed general superintendent of the company to fill the vacancy created by the death of Fred A. Fortine.

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William Groundwater, manager of transportation for the Union Oil Company, has been appointed to the position of director of transportation. In his new position, he is charged with responsibility for all operations of pipe lines and storage, steamships and marine equipment, and tank cars. Mr. Groundwater has come up through the ranks during his 20 years of service with the Union Oil Company, his first job being construction work on the Producers Pipe Line at Creston.

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Tom Moore, Mid-Continent representative of Kewanee Boiler, has been spending considerable time in the East Texas oil fields.

William Groundwater

William T. Mayer has been appointed manager of the San Francisco office of Neilan Co., Ltd. Mr. Mayer is thoroughly versed in public utility engineering as well as in butane plant design. Neilan Company's San Francisco office is located in the Crocker Building.

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John Prater, Pure Oil Company, has been transferred from the Drumright, Okla., district to Van, Texas, succeeding S. W. Barnhardt as gasoline plant superintendent.

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Will C. Barde, formerly chief electrician and in charge of drilling operations for Hall & Briscoe at Oklahoma City, has recovered from severe injuries received while at work.

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Carl B. Campbell of Tulsa, western division lubrication engineer for the Shell Petroleum Corporation, has been promoted to regional lubrication sales manager with headquarters in the Shell Building, St. Louis, Mo. B. L. Buckles, Kansas sales engineer, will go with Mr. Campbell as office assistant. The promotions were effective March 20.

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M. R. Shaffer

M. R. Shaffer, general superintendent of production for The Empire Companies, Bartlesville, Okla., has returned home from Kansas City, Mo., where he has been under medical treatment for several weeks.

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Buck Weaver, representative for Regan Forge & Engineering Company, is now located at 307 South Center Street, Longview, Texas, where he is serving his company in the East Texas oil fields. Previous to his transfer to East Texas he was located in Midland, Texas, representing his company in West Texas and New Mexico.

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Ralph Chamberlin, representative for Ridge Tool Company, spent two weeks in the East Texas fields recently.

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H. A. Ells, construction engineer for Empire Oil & Refining Company, Bartlesville, Okla., was recently married. He has returned from a several weeks honeymoon.

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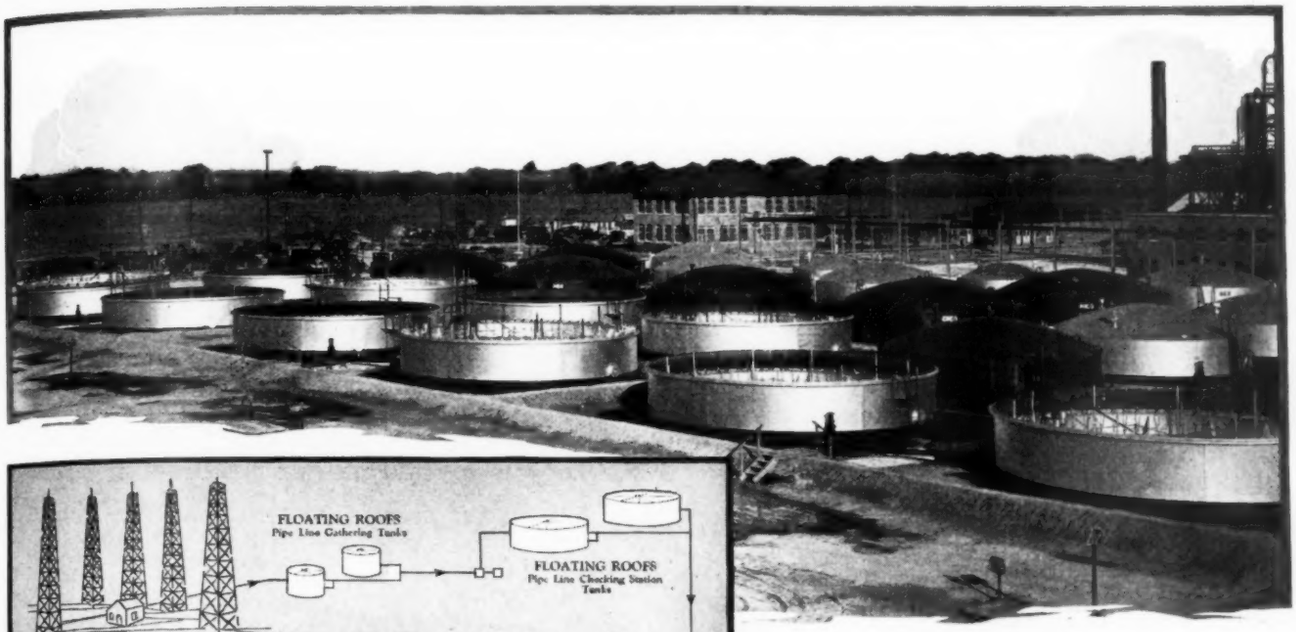
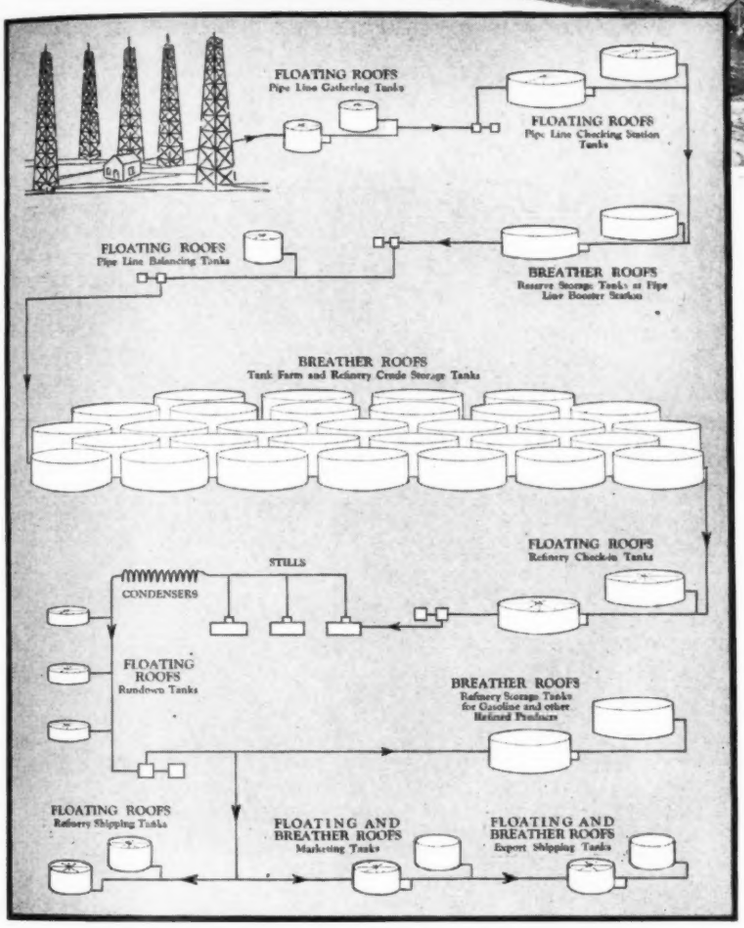
Bruce Barkis, petroleum engineer, has been appointed general superintendent of Rio Grande Oil Company, with headquarters at Los Angeles.





Group of rundown tanks at an oil refinery. Those in the foreground are equipped with Wiggins Roofs.

Where petroleum engineers save money

IN all divisions of the oil industry, from production to marketing and export, petroleum engineers are saving money by the use of Wiggins Roofs and Horton Tanks.

Wiggins Roofs are highly profitable investments. Besides paying their additional cost over ordinary cone roofs in a few months by stopping evaporation losses, they are widely used for reducing fire hazards. The Floating Roof is best adapted to working tanks; the Breather Roof for standing storage.

Are you acquainted with the complete story of Wiggins Roofs? We will be glad to send you printed information on them or discuss their application to your specific problems.

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NEW YORK	3173 Hudson Terminal Bldg.
CLEVELAND	2251 Midland Bank Bldg.
DALLAS	3371 Magnolia Bldg.
BIRMINGHAM	1570 Fiftieth Street North
TULSA	2434 Exchange Bank Bldg.
HOUSTON	1137 Electric Bldg.
DETROIT	1538 LaFayette Bldg.
PHILADELPHIA	1635 "1616" Walnut St. Bldg.
BOSTON	1535 Consolidated Gas Bldg.
SAN FRANCISCO	1064 Rialto Bldg.
SEATTLE	4345 Smith Tower

HORTON TANKS *and* WIGGINS ROOFS

PE4-Gray

When writing CHICAGO BRIDGE & IRON WORKS *please mention The Petroleum Engineer*

G. A. Thompson, purchasing agent for the Empire Companies, Bartlesville, Okla., and member of the executive committee of the National Association of Purchasing Agents, attended a two-day session of that body in New York City during February.

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Charles H. Kopp, formerly process engineer for the Texas Pacific Coal & Oil Company, Fort Worth, Texas, is now with the Empire Oil & Refining Company at Ponca City, Okla. Mr. Kopp is research chemist for the Empire company.

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T. W. Wheeler of Straitsville, Ohio, has succeeded C. A. Ewing, deceased, as superintendent of The Chartiers Oil Company of Pittsburgh, Pa.

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H. M. Macomber, vice-president and general manager of the Geo. F. Getty Oil Company, has moved from Fort Worth, Texas, to Carlsbad, New Mexico.

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Carl Witschy, field superintendent for Arkansas Fuel Oil Company, has moved from Westerville, Ohio, to Robinson, Ill., where he will now make his headquarters.

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A. V. Simonson, New York representative of the Gaso Pump & Burner Company and Lufkin Foundry & Machine Company, has been spending some time in Texas and Oklahoma.

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C. E. Whitney, assistant sales manager, Baker Oil Tools, Inc., was a recent Mid-Continent territory visitor.

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Joseph P. Triplett, previously foreman for Magnolia Petroleum Company in the Yale (Okla.) district, has been transferred to Wichita, Kan.

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M. F. Waters and Dick Battle of Hanlon-Waters, Inc., Tulsa, are in the East Texas oil fields in the interests of their company.

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S. B. Daugherty has been placed in full charge of development and research work for the National Transit Pump & Machine Company, Oil City, Pa. Mr. Daugherty is known to the natural gas industry as a designer, technical gas man and consulting engineer of prominence.

Charles H. Kopp

C. E. Whitney

B. A. Kelly is now warehouse foreman for the Oklahoma Pipe Line Company at Seminole, Okla.

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J. M. McNeal, European sales manager of the Landis Machine Company, Waynesboro, Pa., sailed February 14 for England after a three weeks visit to the home office. Mr. McNeal has his headquarters at Birmingham, England, but supervises the sale of Landis threading equipment both in Great Britain and continental Europe.

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W. E. Dunlap has resigned as vice-president in charge of production for Richfield Oil Company to become executive director of the Independent Petroleum Association of California.

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G. E. Moreland recently became connected with the Byron Jackson Co. in an executive capacity, with headquarters at the general offices of the company in Los Angeles. Mr. Moreland is well known in several branches of the petroleum industry, particularly through his late connection with the Western Forge Company as president. Prior to that time he was with other organizations connected with the oil business.

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R. V. Whitman, formerly superintendent and chief engineer with the Standard Oil Company of Venezuela and Creole Petroleum Corporation, is now associated with Joseph Breslove, consulting engineer, Oliver Building, Pittsburgh, Pa.

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S. V. Stewart, vice-president and general manager, Ajax Iron Works, Corry, Pa., was recently on a trip through the Mid-Continent and Gulf Coast fields.

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Frank Weaver, vice-president, and L. N. Strunk, of the General Chemical and Solvents Corporation, Boston, Mass., were in Tulsa a few days recently, looking over several pipe lines building in the vicinity.

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A. L. Faber, engineer of the Arkansas Power & Light Company, has been spending some time at Houston, Texas.

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A. M. Bowman, Parkersburg Rig & Reel Company, Tulsa, has been in Texas on a business trip.

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Albert H. Wehe has accepted a position with the Hydro Engineering and Chemical Company of Elizabeth, N. J.

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David L. Trax

Everett Gooch, Pure Oil Company, Muskogee, Okla., is now located at Toledo, Ohio, headquarters of the Pure Oil Company.

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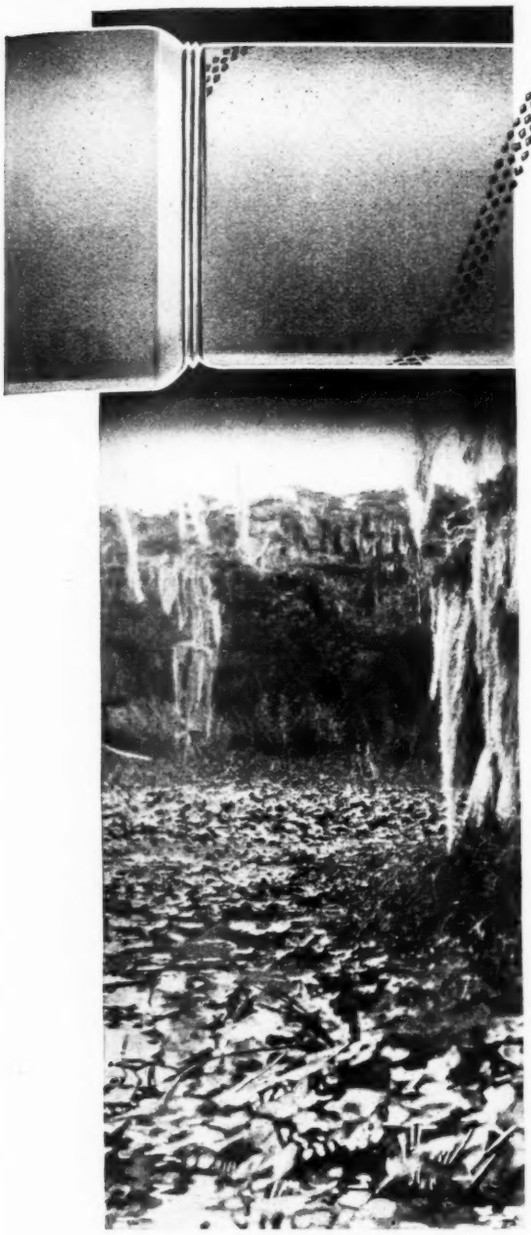
W. K. Whiteford, chief production engineer of the Barnsdall Oil Company, was elected chairman of the Mid-Continent district of the American Petroleum Institute's division of production at its annual meeting held in Tulsa, March 26 and 27. He succeeds Reid W. Bond, production engineer of the Shell Petroleum Corporation. David L. Trax, chief engineer of the Gypsy Oil Company, was elected vice-chairman. E. L. ("Ernie") Bell, Deep Rock Oil Company, was re-elected secretary-treasurer.

W. K. Whiteford



Here's a REAL Specification for Swamp and River Crossings . . . and the Honest Spiral Makes Sure That it is Filled!

"I want line pipe that will stand up where corrosive conditions are worst—in the oozy slush and corrosive slime of swamps and rivers—and I want such pipe at the lowest cost for which I can buy proved safety. Therefore, make all our swamp and river crossing pipe Reading Genuine Puddled Wrought Iron."

And you can make sure that you get the same kind of pipe that has been giving unfaltering service for generations wherever oil is produced or transported. Look for the permanently indented Reading spiral on every foot of swamp and river crossing pipe that goes into your line.

For Reading uses today, as Reading has used for 83 years, genuine puddled wrought iron to make the same staunch pipe that resists rust, corrosion, electrolysis, vibration and fatigue as does no other metal. Be sure you get Reading 5-Point Pipe for swamp and river crossings.

For your protection this indented spiral forever marks all Reading Pipe.

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Tubing	Couplings	Cut Nails
Casing	Bar Iron	Boiler Tubes

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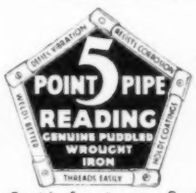
READING 

PIPE

Science and Invention Have Never Found a Satisfactory Substitute for Genuine Puddled Wrought Iron

When writing READING IRON COMPANY *please mention The Petroleum Engineer*

W. B. Allen, production engineer of the Standard Oil Co. of Venezuela, arrived in New York the latter part of March and will return to Venezuela after spending his vacation in the United States.

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B. F. Harris

B. F. Harris, president of the Oil Well Supply Co., of Pittsburgh and Oil City, Pa., has completed a tour of the oil fields of the United States. From the eastern fields Mr. Harris went to California, thence to the Gulf Coast area and north through the Mid-Continent before going home. He was accompanied by Leon F. Payne, treasurer of the company.

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C. A. Drew, foreman for the Empire Oil & Refining Company, has been transferred from Seminole, Okla., to Oak Hill, Kan.

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J. F. Corcoran of Trimont Manufacturing Company is spending some time in Fort Worth, Dallas and in the East Texas oil fields.

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W. L. Connelly, vice-president in charge of foreign activities of the Sinclair Consolidated Oil Company, has been spending some time in Tulsa.

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A. M. Butcher has been appointed purchasing agent of the Indian Territory Illuminating Oil Company, Bartlesville, Okla. He succeeded W. L. Muir, who has resigned to engage in other business. Mr. Butcher was previously sales engineer for the Happy Belting Company, Tulsa, and prior to that was assistant purchasing agent of the Empire Companies, Bartlesville.

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S. K. Karaeff, superintendent of production and drilling for the Amtorg Trading Corporation, Baku, Russia; J. J. Goeff, mining engineer, Azneft Oil Trust, Baku, Russia; V. K. Machnoff, mining engineer, Azneft Oil Trust, Baku, and Miss H. I. Konevetz, secretary export department, Amtorg Trading Company, New York City, were recent visitors in Tulsa. They were on their way to New York, from where they will soon depart for Russia. They have been in California and many Mid-Continent fields.

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W. W. Scheumann

W. W. Scheumann, formerly chemist with the Cities Service Refining Company, Braintree, Mass., has been made chief chemist of the Empire Oil & Refining Company, Okmulgee, Okla. He succeeds A. L. Davis, who was sent from Okmulgee to New York City to be connected with the Henry L. Doherty Co.'s patent research department.

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A. H. Carson, Oklahoma City, factory representative of the Ajax Iron Works, Corry, Pa., has returned from a seven weeks trip to the Gulf Coast, where he made a test on drilling condensers.

C. W. Carlson, representative for Jenkins Brothers, valve manufacturers, with headquarters in San Antonio, Texas, spent some time in Tulsa recently, calling on the trade.

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E. H. Weaver, district purchasing agent, Union Oil Company of California, for the Northwest, has accepted the chairmanship of the National Committee on Uniform Marking of Valves and Fittings.

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William Hoskinson, until recently superintendent of gasoline plants for the Magnolia Petroleum Company at Oklahoma City, has been transferred to the production department with headquarters at St. Louis, Okla.

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O. H. Seal has been added to the New York City staff of Neilan Co., Ltd. Mr. Seal has had a number of years' experience in the refining industry.

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A. G. White, formerly chief engineer, Magnolia Gas Company, Pineland, Texas, is now chief engineer at the Goodrich (Texas) compressor station of Dixie Gulf Gas Company.

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Harvey Hardison, chief production engineer, southern district, The California Company, was elected chairman of the Hobbs engineering committee at the last meeting of the advisory board.

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J. E. Sloan

J. E. Sloan, formerly with the Union Wire Rope Company, is now district manager in Tulsa for E. H. Edwards Wire Rope Company with offices at 506 Thompson Building.

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Ray Koller, petroleum engineer with the Carter Oil Company, recently has been transferred to the production department, where he will work with Lawrie Bowman, superintendent of production in the Seminole area.

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T. F. Lydon, executive vice-president of the Shell Petroleum Corporation, is visiting the Gulf Coast properties of his company, including the Houston refinery.

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H. P. Taubman, president, Taubman Supply Corporation, is back in Tulsa after a trip through East Texas and the Gulf Coast oil fields.

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Joe Omo is general manager of the Equipment Manufacturing Company of Wichita Falls, Texas. He was formerly with the 3-D Corporation of Fort Worth.

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R. W. (Kid) Lowe, general superintendent of S. O. of Louisiana, vowed he'd never take an airplane ride, but Erle Halliburton took him up last month.

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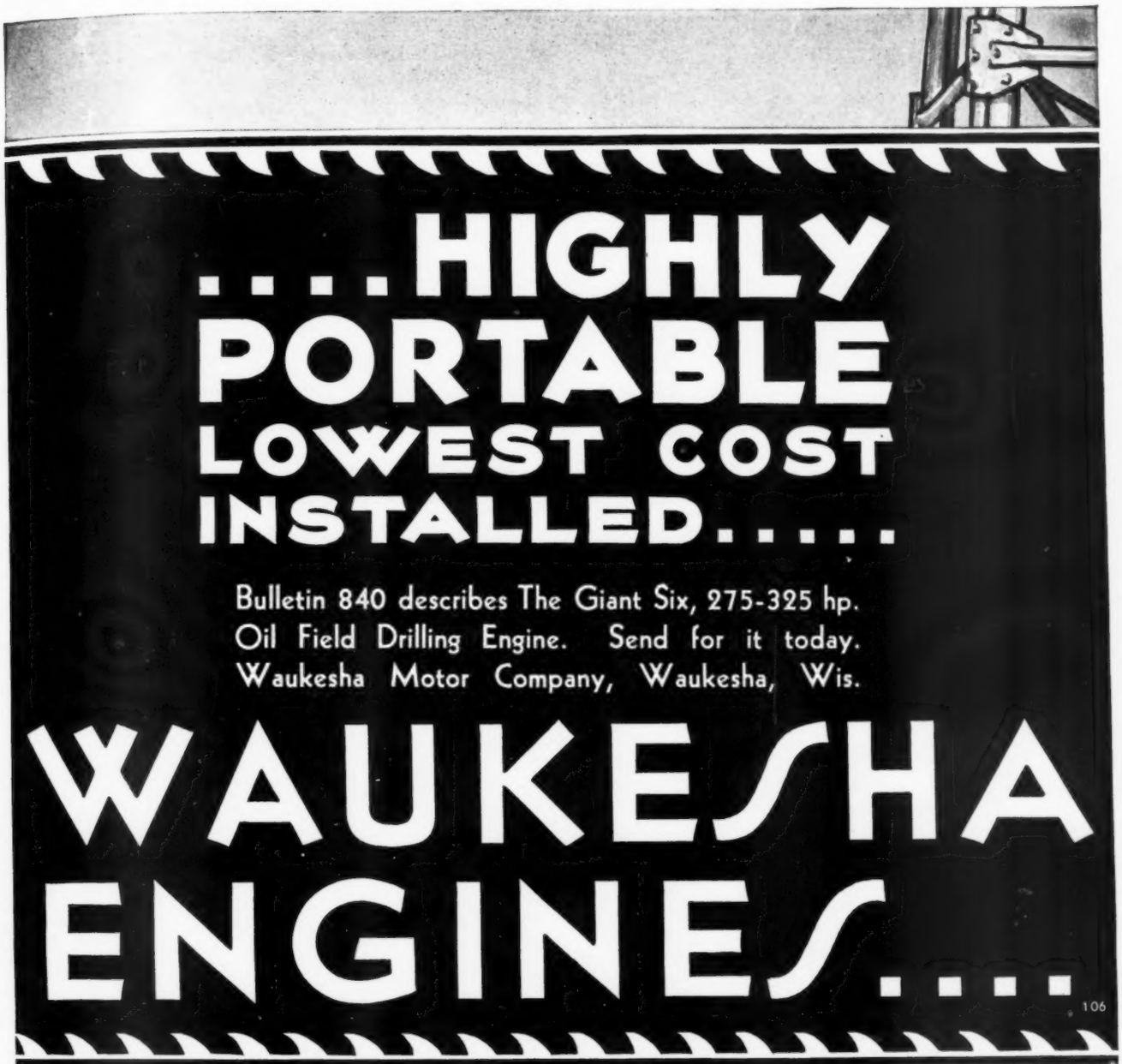
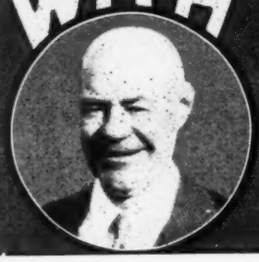
Fred Hayes of Goulds Pumps, Seneca Falls, N. Y., has left his headquarters in Dallas, Texas, to spend about six weeks at the company factory.



When writing WAUKESHA MOTOR CO., *please mention The Petroleum Engineer*

LAUGH WITH BARNEY



***Edited by* BARNEY HORRIGAN**

"Bill" Chisholm, Arkansas-Louisiana manager of the Halliburton Oil Well Cementing Co., is depressed because authorities won't let his children join the Boy Scouts. Reason—his children are all girls.

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New Bank Clerk: Miss Jones, do you retire a loan?

Stenog: No, I sleep with Aunt Emma.—Boston Beanpot.

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He Golfer: "Well, caddie, how do you like my game?"

Caddie: "I suppose it's all right, but I still prefer golf."—Union Electric Magazine.

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Little Albert says the only reason that there are end zones in a college stadium is to locate the seats of the student body.—Notre Dame Juggler.

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Among the Want Ads in London

Widow wants washing.

Wanted a horse to do the work of a country minister.

Wanted by a young woman, her passage to Canada, willing to take care of children and a good sailor.

Inventor of a new type go-cart, wishes to meet financier to push same.

Mr. Furrier begs to announce that he will make furs, coats, etc., for ladies out of their own skins.

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As You Were

A gent alcoholically oversubscribed, wandered into a movie. During the intermission, while the audience was being bored with announcements of future films, the drunk got to his feet and called out:

"Is there a doctor in the house?"

There was. A man down in the third row stood up, saying, "I'm a doctor."

The drunk smiled amiably. "Hello, doctor," he said, and sat down.

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A group of men at the club were discussing the color of their wives' hair, and Jones was the only man who couldn't remember. He decided to rush right home and find out. Dashing into the living room he found his wife sitting on the davenport; he looked at her hair, and cried:

"Brown!"

And from behind the davenport came a surprised voice:

"Now, how did you know I was here?"

Why Editors Turn Gray

The inevitable "bad break" of the compositor is the despair of editors in general. The following "prize" one appeared on the oil page of one of the prominent Mid-Continent dailies:

"Of the total amount of gasoline produced, 2,746,000 barrels was recovered from treatment at a hospital in Kansas City."

"I like to go out with Jane."

"Why's that?"

"Her father owns a speakeasy and she won't talk."

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Her hat was on one side, her clothes rumpled and her shoes were in shreds.

"Were you knocked down by a motorist?" asked a sympathetic bystander.

"No, picked up," she snapped.—Ex.

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A Scotchman once helped a friend out with his income tax. Yeah. He came to live with him as a dependent. —Ex.

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Perfect Hostess

A deaf old lady went to live near one of the naval ports. Shortly afterwards a battleship fired a salute of 10 guns. The old lady, who lived alone, got out of her chair, smoothed down her dress, patted her hair, and said sweetly, "Come in."—Tit-Bits.

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Frank: What did you do with the blonde you had out last eve?

Ernie: Oh, I gave her the air. She turned out to be one of those Iowa girls.

Frank: What do you mean Iowa girls?

Ernie: You know, I owe a month's rent, etc.—Grinnell Malteaser.

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Otherwise OK

A California man suing his wife for divorce after less than two years of marriage, says that she is "sullen, mean, irritable, morbid, disagreeable, nasty, gruesome, cool, bitter, jealous, heckling, picayunish, loathsome, insulting, brazen, miserly, gluttonish, temperamental, selfish, contemptuous, inattentive, uncivil and inconsiderate."

"How big is your ice skating rink?"

"It seats two thousand."

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"How can I make anti-freeze?"

"Hide her woolen pajamas."—V. M. I. Sniper.

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Saddest Story of the Month

A man's wife had been away for a month. He wrote her every week telling her how he was spending the evenings at home. When the wife came back the light bill came in—for fifty cents.

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Wrong

A motorcycle cop pulled up beside a car parked on a country road in the wee small hours of the morning.

"Hey," he yelled, "what business have you got to be out here at this time of night?"

"This isn't business," came a voice from within, "it's a pleasure!"—Ex.

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Hannen Swaffer, the captious critic, tells of an old lady in 'Amstead 'Eath who was taken with pains on the appendicitis side. The new district medico was called in, made examinations, quieted fears and went his way. That evening the old lady remarked to her daughter:

"It was nice of the new vicar to call."

"But, mumsie, that wasn't the vicar; that was the doctor.

"O," said the old lady, musing, "I thought he was a little familiar for a vicar."—O. O. McIntyre in the New York American.

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An Artist

"A flirt, am I?" exclaimed the maid, under notice to go. "Well, I knows them as flirt more than I do, and with less excuse." She shot a pitiful look at her mistress, and added, "I'm better looking than you. More handsome. How do I know Your husband told me so."

"That will do," said her mistress frigidly.

"But I ain't finished yet," retorted the maid. "I can give a better kiss than you. Want to know who told me that, ma'am?"

"If you mean to suggest my husband—"

"No, it wasn't your husband this time. It was your chauffeur."

PICTORIAL PETROLEUM

MONTHLY ROTOGRAVURE FEATURE OF THE PETROLEUM ENGINEER

THIS MONTH FEATURING EAST TEXAS
PRESENT CENTER OF ACTIVITY

APRIL 1931

Street scene in Longview. The two-story building at the left houses the East Texas Chamber of Commerce. The brick structure at the right is the Gregg Hotel. Plans are being formulated now to build between the two a new eight-story Petroleum Building costing $400,000.

Scene taken near the railway station at Kilgore at the beginning of the oil boom.

The boom is here well under way as evidenced by the congestion on the main street of Kilgore.

Scenes in East Texas

Left to right—B. A. Skipper, oil producer, J. M. Jeffries, head driller and F. K. Lathrop, owner of Lathrop farm on which the discovery well in Gregg County (shown in the picture) was completed.

Traffic jam on the road leading into Kilgore.

This is not a Louisiana rice field but one of Kilgore's main thoroughfares after a rain.

The first building on a proposed townsite south of Kilgore.

Field scene in the Bateman area.

Left—A section of supply row in Kilgore. Mules have come into their own in East Texas, being used extensively for emergency hauling. Right—A field scene in the Joinerville area.

Fields and Oil Towns

One mule in this picture appears to have bogged down on the muddy thoroughfare. There is no cause for alarm, however, as he merely balked and the driver is getting ready to throw dirt in his left ear, a popular method of dealing with stubborn mules.

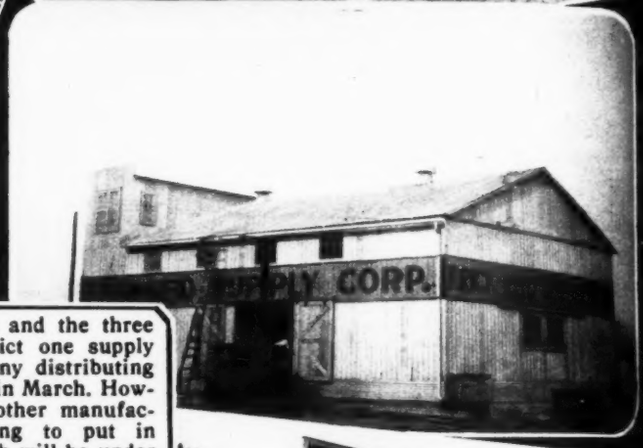
The J. W. Olvey No. 1 Crim well in the Bateman area is here being washed in to completion, the oil blowing into the slush pit.

Left—Humble Oil & Refining Co. camp under construction. Right—A portion of supply row in Kilgore. Below, left—There seems to be no lack of activity in this scene taken on the main street of Kilgore. Below, right—A section of Joinerville, an important East Texas oil town.

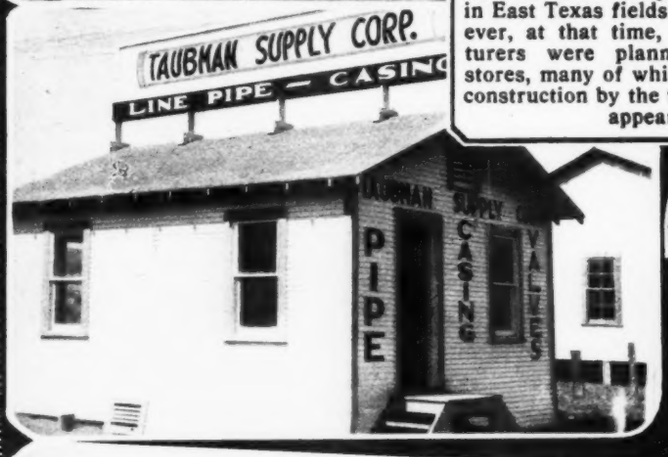
Transporting a heavy boiler by tractor to a well near Kilgore.

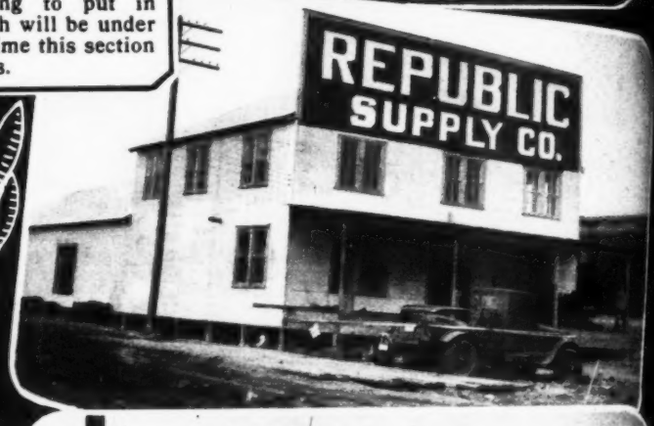
Supply Stores Serving Kilgore

The National Supply Company's store at Kilgore.



Photographs on this and the three pages following depict one supply store of each company distributing in East Texas fields in March. However, at that time, other manufacturers were planning to put in stores, many of which will be under construction by the time this section appears.





East Texas Fields

Kilgore

Kilgore office of Black, Sivalls & Bryson, Inc.

Parkersburg Rig & Reel Co. is now putting up a warehouse on this site.

Supply Stores Serving E

Kilgore

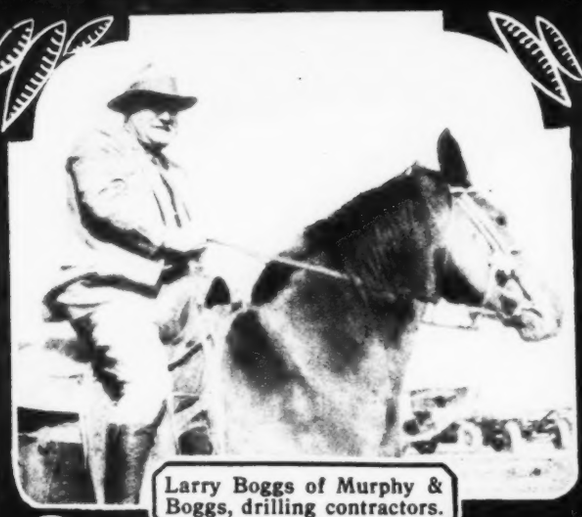
Pelican Well Tool & Supply Co. store.

East Texas Fields

Joinerville

Longview

F. A. Kingery, assistant to the vice president of Oil Well Supply Co.

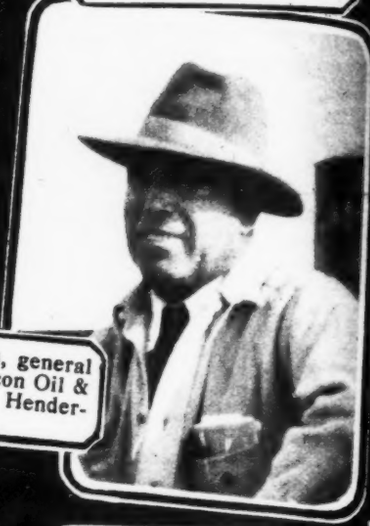


Larry Boggs of Murphy & Boggs, drilling contractors.

Frank Foster, independent operator, who is extremely active in East Texas.

On this and the opposite page ~ ~ ~ A few of the many operating men and manufacturers' representatives active in East Texas fields ~

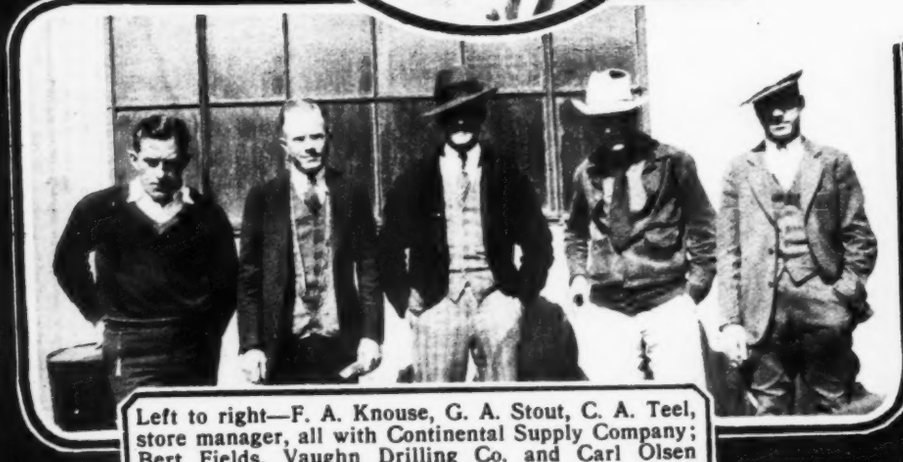
C. M. Watts, construction superintendent, East Texas Refining Company, Henderson.



T. P. Cannon, general manager Beacon Oil & Refining Co., Henderson.

Charles F. Dougherty, Tulsa district manager for Larkin Packer Co.

Tom Moore, representative for Kewanee Boiler Corp.



Left to right—F. A. Knouse, G. A. Stout, C. A. Teel, store manager, all with Continental Supply Company; Bert Fields, Vaughn Drilling Co. and Carl Olsen with Walworth Co.

C. E. Barron, store manager for Taubman Supply Corp.

Burton Prince of Prince Bros. Drilling Company.

Left to right—Paul Kitchen, formerly with Oil Well Supply Company; "Shep" Miers, Kerotest Mfg. Co.; Joe Fulton, Norvell-Wilder Supply Co.; and Bill Lynd, superintendent for Ed Jones, oil producer.

Left to right—J. I. McDough with T. T. Word Supply Co.; J. T. Shaw, with the same company; R. D. Poindexter, representative for Rathbun Company; C. A. Scholle, with the Ohio Injector Co.

Joe Hicks, Jr., with Robinson & Hicks drilling contractors, astride his good steed "Spark Plug".

M. D. Routzon, store manager for Oil Well Supply Company (left) and C. E. Markey of Link-Belt Company.

Sam H. Clopton with Howard Smith Co., Houston, Texas (left) and L. R. Spencer with the Boykin Division of International Derrick & Equipment Company.

J. D. Hicks, Sr., of Robinson & Hicks, drilling contractors, and John W. Sloan, general store manager for International Supply Company.

S. H. Carter, Chattanooga, Tennessee, representative for American Manufacturing Co., and Lee Irby, representative for Beaver Stock & Die Co., photographed recently in East Texas.

D. M. (Red) Griffith of Bettis Sales Co., Houston, Texas, doing a hard day's work at the mouth of the Bernard River near Allen Dome, Texas.

Fred D. Clark, superintendent for the South Penn Oil Company at Folsom, West Virginia.

C. H. Snyder, purchasing agent, Forest Oil Company, Bradford, Pa.

Dave Cowden, assistant purchasing agent, Arkansas Natural Gas Corp., Shreveport, La.

A group of well-known production men photographed recently at Huntington Beach, Calif. Left to right—W. G. Corey, factory representative for Pacific Gear & Tool Works, Los Angeles; A. J. Rosenleib, superintendent, Ohio Oil Co., Venice field; Sam Furman, production foreman, Ohio Oil Company, Venice field; Walter Thompson, superintendent, Standard Oil Company of California, Huntington Beach; Wm. Henry, tool pusher, Standard Oil Company of California, Huntington Beach; Horace Thompson, also with the Standard at Huntington Beach.

Mr. and Mrs. Ben H. Meaker, Tioga, Pa., owners of the Meaker gas well recently given nationwide publicity as the largest gas well east of the Mississippi River.

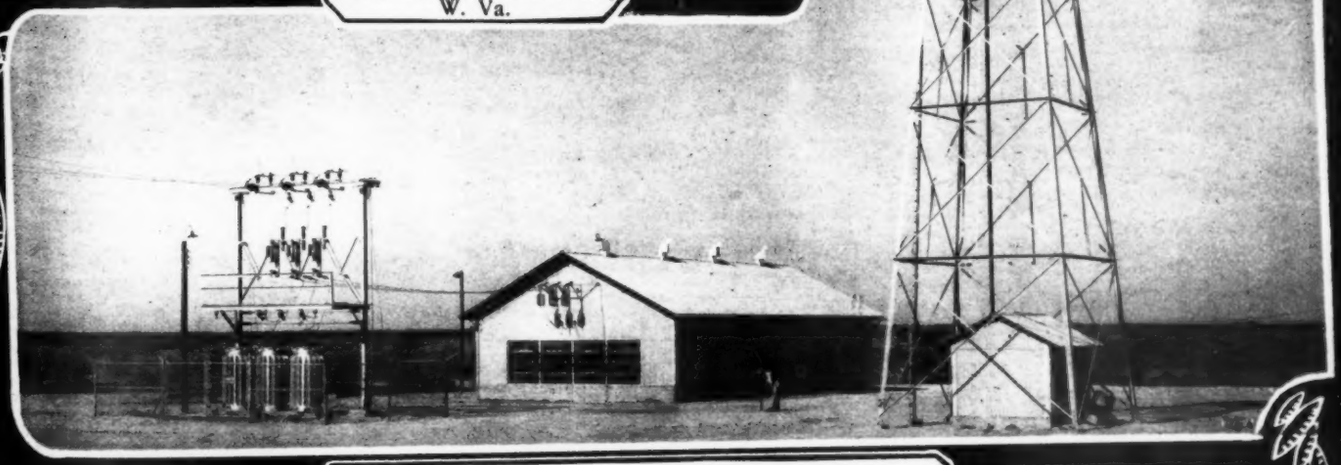
W. H. Cox, store manager for Oil Well Supply Company at Prestonburg, Ky. Mr. Cox, by the way, is one of the Oil Well's youngest store managers.

W. S. Hovis, Forth Worth, Texas, representative for Broderick & Bascom Rope Company.

10,000 barrel Hortonspheres at a refinery in Houston, Texas. These were manufactured by Chicago Bridge & Iron Works, Chicago, Illinois.

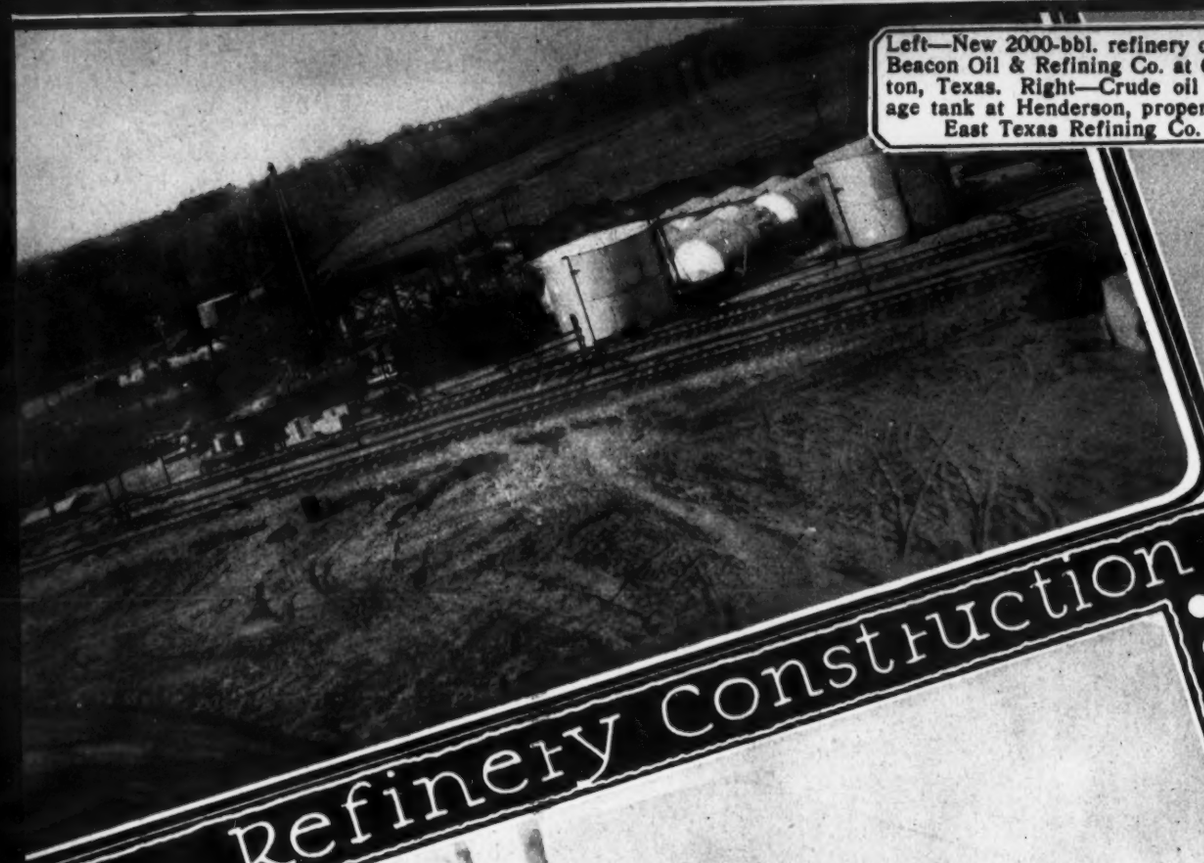
J. P. McMurrer, superintendent, South Penn Oil Co., Charleston, W. Va.

A. S. Haught, superintendent Wetzel district, South Penn Oil Co., Smithfield, W. Va.

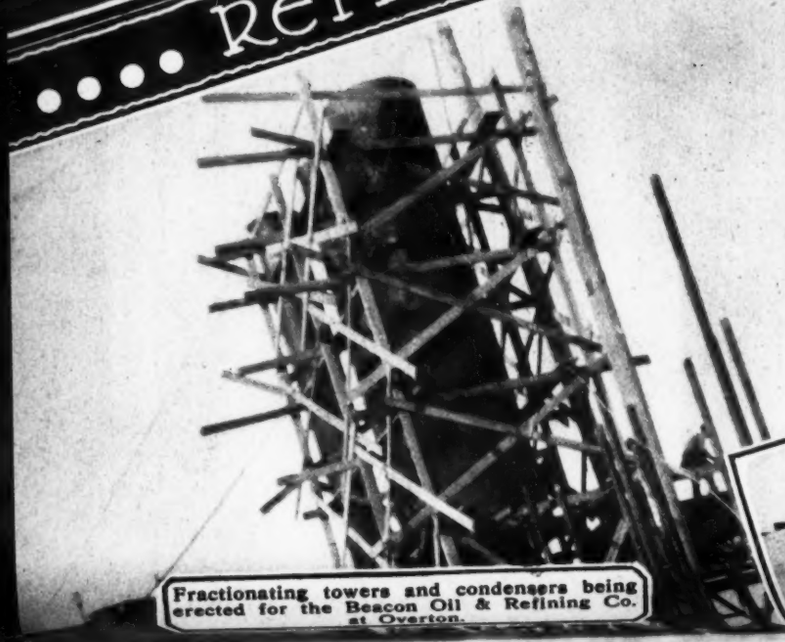


Crane, Texas, station of The Texas Pipe Line Company.

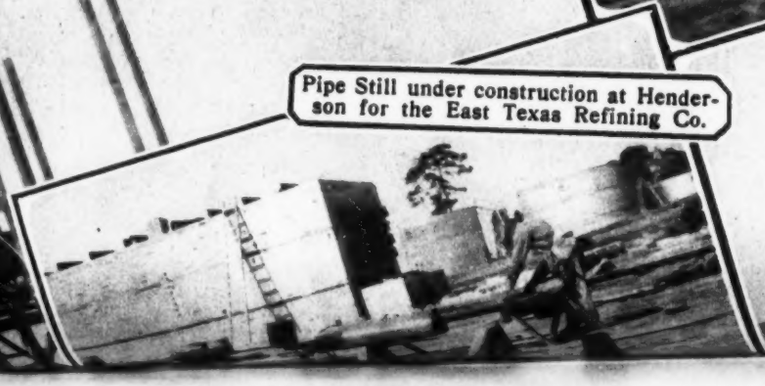
Refinery Construction in East Texas



Left—New 2000-bbl. refinery of the Beacon Oil & Refining Co. at Overton, Texas. Right—Crude oil storage tank at Henderson, property of East Texas Refining Co.

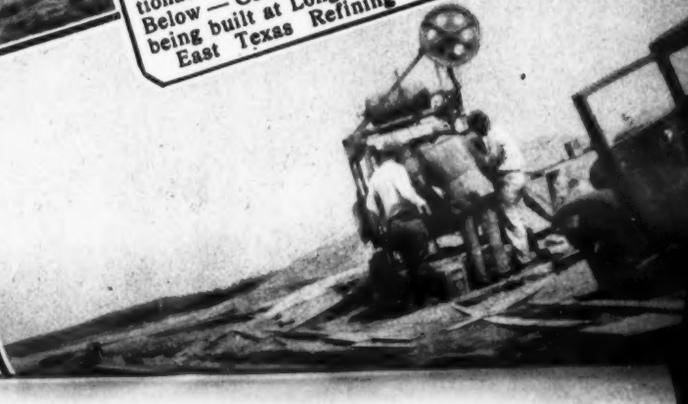


Fractionating towers and condensers being erected for the Beacon Oil & Refining Co. at Overton.



Pipe Still under construction at Henderson for the East Texas Refining Co.

Above — East Texas Refining Company's condenser and fractionating tower at Henderson. Below — Concrete foundation being built at Longview for the East Texas Refining Co.



Methods Used *in* Capping Tioga Wild Well

CAPPING of the Penn-United Gas Company's wild gas well on the Ben Meaker farm near Tioga, Pa., successfully and safely, is a tribute to modern skill and methods in handling unruly wells. This well, which got out of control about February 17, was on March 5 securely closed in after blowing wild for 15 days at a rate variously estimated from 60 to 100 million cubic feet per day. The estimated rock pressure is 1800 pounds per square inch.

When the well blew out it had approximately 3300 feet of open hole, having been cased only to 870 feet with 8¼-inch casing. There also was 70 feet of 10-inch surface pipe in the well, and, as neither the surface pipe nor the 8¼-inch string was cemented, it necessitated running a string of casing while the well was flowing before it could be brought under control. Arrangements were therefore made to run some 5⅜-inch casing. It took about three days to make the necessary preparations and get this job under way.

Attempts were made to run a packer on the shoe, but the gas pressure was so great that, after several futile attempts to get the casing started in the hole, the idea was abandoned. Instead, the plan of running the casing to bottom (4200 feet) was followed and to pump cement behind the 5⅜-inch to obtain a good shut-off. As the casing had to be run while the well was flowing, it exposed the crew to tremendous hazards.

In starting the tubing in the well it was necessary to snub in the first four joints. For this purpose four winches were used, one on each side of the derrick. Snubbing in these first four joints was slow work. As more weight was added, the casing in the well was more secure in resisting the flow of gas from the well. It took several days to run the casing, as every precaution was taken to protect the workers and the well from injury. By carefully landing the string of 5⅜-inch casing on a shoulder a few feet from the bottom, the flow of gas was diverted almost entirely inside the casing.

At this point cementing operations were begun. The amount of cement mixed and pumped down between the 8¼-inch and 5⅜-inch casing was 550 sacks. This was done while the well was flowing through the 5⅜-inch. In order to minimize the risk of collapsing the lower end of the 5⅜-inch casing that might occur due to the head of cement behind it, when 250 sacks of cement had been placed, a pressure of 600 pounds was built up inside by slightly closing the master gate valve before pumping in the remaining 300 sacks. Only one and a half hours were required to place the cement.

Not until the cement had been allowed to set for 24 hours was the well completely closed in. This was a creditable piece of work and C. H. Kincaid, in charge of Halliburton cementing operations in Michigan, who supervised the cementing job, and his associates are to be congratulated. Also those in charge of the well and the casing crews are to be commended.

Left — Running in the 5⅜-inch casing while the well is blowing wild. Right — Attempting to place a joint of 12½-inch casing over the well to carry the gas from the derrick floor.

Above—Close-up of the Christmas tree just before the well was shut in.

Fractionating towers and condensers being erected for the Beacon Oil & Refining Co. at Overton.

Always a Step Ahead

Tulsa TULSA TYPE Oklahoma

CHANGING industrial conditions and progress in operating methods necessitate the highest degree of efficiency in refinery and natural gasoline plant equipment. Guided by that fact, Tulsa Boiler & Machinery Co. maintains an exceptionally large staff of experienced engineers upon whose shoulders rests the burden, not only of keeping pace with modern requirements but, what is even more important, anticipating the needs of the industry. The recognized ability of these men is responsible for their being called in where construction and equipment designing problems are most complex.

Our strategic location in the heart of the vast Mid-Continent area not only enables us to guarantee quick deliveries, but affords our engineers an opportunity to conduct research under actual operating conditions. This advantage is reflected in the flexibility and dependability of Tulsa-Type equipment.

When you have a problem involving installation or use of distillation, fractionating or other refinery or natural gasoline plant equipment, we shall be pleased to place our organization and facilities at your disposal.

OUR fabrication plant is one of the best, and our stock of material the largest in the southwest. We are prepared to manufacture any type of column, tower or heat transfer equipment. If your problem concerns the manufacture of such equipment, it would be to your advantage to get in touch with us.

TULSA
Boiler & Machinery Co.
TULSA, OKLAHOMA

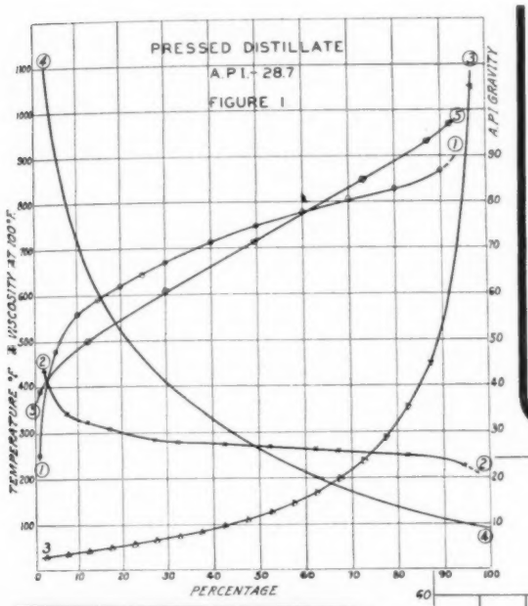
NATURAL GASOLINE PLANTS TANKS REFINING EQUIPMENT

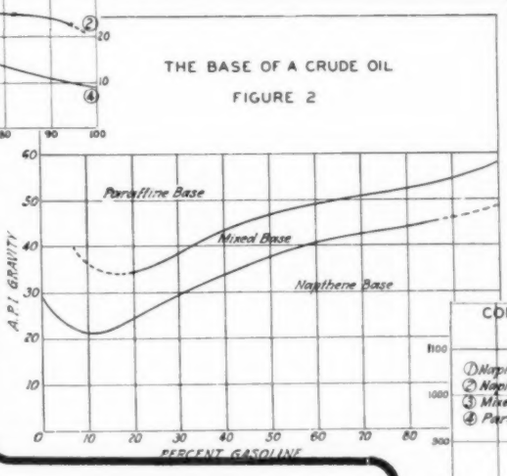
When writing TULSA BOILER & MACHINERY CO., *please mention The Petroleum Engineer*

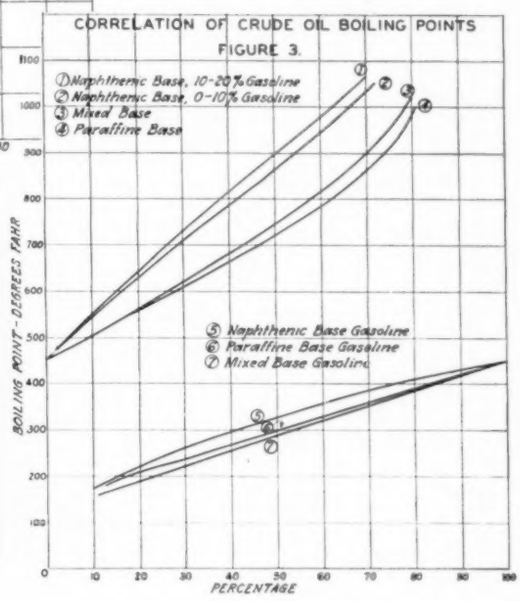
Evaluation *of a* Crude Oil

By W. L. NELSON,
Professor of Petroleum Engineering,
University of Tulsa

THE first article of this series* dealt with the physical properties of hydrocarbons probably present in crude oil. Attempt was made to accumulate enough data to lend practical value to these properties and to point out how applications might be possible. The same purpose applies to this article. The working value of the material presented is in no way lessened by the fact that it is largely empirical. As pointed out in the last article, petroleum design engineers cannot be too exacting with respect to design data because such data, at the best, are inadequate.







Plant information regarding crude oil is far too expensively gained to be used exclusively for evaluation purposes; hence we are forced to resort to the laboratory for most of our fundamental data. However, before we can use such information we must assure ourselves that the laboratory evaluation duplicates that of the plant. As much of the following procedure as can be correlated with plant results has been found dependable.

Engineers must know the yields obtainable and the properties of the various products. In completing this information in the laboratory it is important to ascertain (1) true boiling point distillation (T. B. P. C.), (2) flash vaporization distillation curve (flash yield curve), and (3) viscosity and gravity curves from the cuts obtained in the T. B. P. distillation (viscosity mid per cent curve, gravity mid per cent curve and viscosity yield curve). A description of these curves, methods by which obtained, limitations and applications follow:

The True Boiling Point Curve

The true boiling point curve has been adopted because it can be reproduced, it provides ultimate possible yield figures (good fractionation) and allows property correlations not possible with other methods of distillation.

For obtaining this, the equipment described in the following paragraph works quite satisfactorily:

A three or four litre sample is charged into a glass flask to which is sealed a glass-packed column approximately four feet in length. The column is surrounded by two air-jackets, one for static air and the other for an air current to maintain adiabatic conditions. Adiabatic conditions are effected by a flow of heated air and a resistance coil in the jacket to sustain the temperature. Reflux is provided by another air jacket about the column head. The whole system, still, column, condensers and receivers, can be operated under vacuum conditions as low as 2 mm. Distillation under either atmospheric or vacuum conditions proceeds at a rate of 100 cc. in 15 to 20 minutes. The column is operated just below the condition of "flooding." All data contained in this article are based on distillations conducted in this type of equipment.

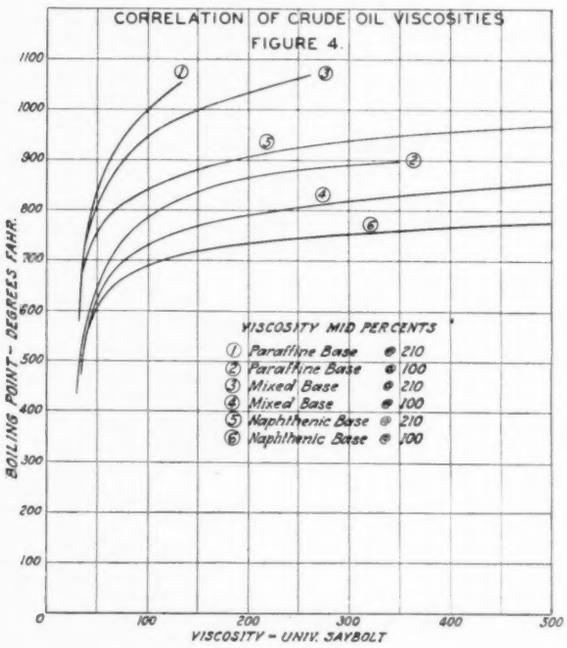
The distillation curve, Figure 1, Curve 1, is obtained by plotting the vapor temperature against the percentage distilled. For a true boiling point distillation a curve of this kind is substantially a

*February issue.

differential curve, or at least may be treated as such.

The A. P. I. Mid Per Cent Curve

This curve, Figure 1, Curve 2, is obtained by plotting the A. P. I. gravity of each cut at the mid-percentage point of the cut. Again, such a curve is differential because the instantaneous value of the gravity is plotted against its instantaneous percentage point. Certain properties are inherently additive, that is, the property of a mixture of two or more materials is an arithmetic average of the properties of the materials. Boiling point and gravity are both substantially additive properties. Such properties, taking gravity as an example, may be averaged by integrating the gravity between the limits of the cut and dividing by the percentage contained in the cut. Integration may be most easily handled by graphical methods. Furthermore, throughout those sections of the curve which are a straight line, or are approximately straight, the foregoing method amounts merely to determining the 50 per cent point of the cut. In other words, the average gravity or B. P. of a cut, located in a slightly curving portion of the curve, may be determined by noting the value of the respective property at the 50 per cent point of the cut. At the upper and lower extremities of the curve, integral-averaging should be employed.


CORRELATION OF CRUDE OIL VISCOSITIES
FIGURE 4.
BOILING POINT - DEGREES FAHR.
VISCOSITY - UNIV. SAYBOLT
VISCOSITY MID PERCENTS
① Paraffine Base @ 210
② Paraffine Base @ 100
③ Mixed Base @ 210
④ Mixed Base @ 100
⑤ Naphthenic Base @ 210
⑥ Naphthenic Base @ 100

The Viscosity Mid Per Cent Curve

This curve, Figure 1, Curve 3, is obtained, as the gravity curve, by plotting the viscosity of the fraction at its mid-percentage point. Viscosity is not an additive property, as evidenced by the numerous blending charts in the literature, and cannot be integrally averaged. However, empirically it has been found that the 50 per cent point of a cut does indicate the actual viscosity of the cut, provided the cut is not too large or on too sharply curving a portion of the curve. Apparently the blending characteristics and the curvature of the differential viscosity curve, exactly counterbalance one another so that the viscosity at the 50 per cent point of a cut is the true viscosity of the cut.

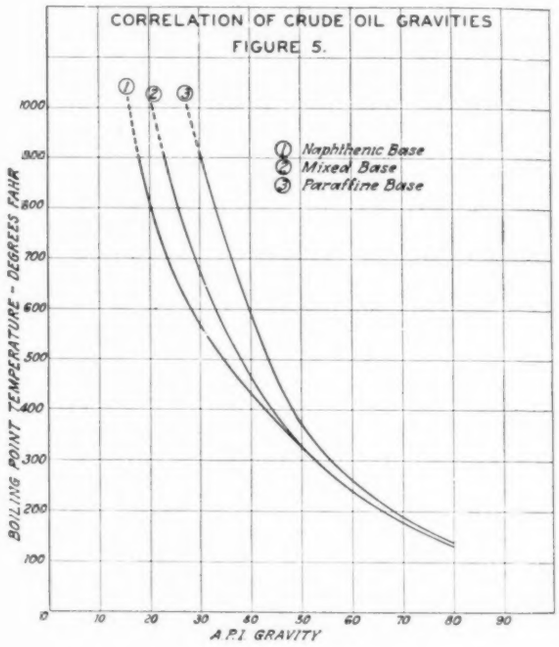
The Viscosity Yield Curve

This curve, Figure 1, Curve 4, represents the viscosity of the bottoms as various percentages of bottoms are produced. It may be obtained by sampling the bottoms during the distillation, although equally dependable results may be obtained by preparing a synthetic bottoms corresponding to various percentages of residual stock. The synthetic bottoms is prepared by blending back aliquot parts of the overhead cuts with the final bottoms.

The Flash Yield Curve

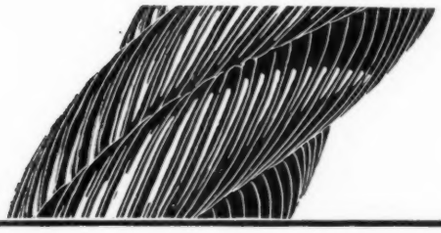
Figure 1, Curve 5, was obtained with equipment similar to that used by Leslie & Good,[a] and Piroomor & Beiswenger.[b] The whole body of the oil is heated rapidly to the vaporization or distillation temperature in almost an exact duplicate of pipestill practice. Such a curve represents the accumulative effect of the vapor pressure of every constitutent present in the oil.

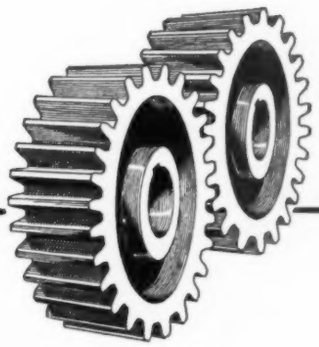
Having available such information as that given in Figure 1, the engineer is able to design wisely. The following are three sets of materials which may be produced from the pressed distillate of Figure 1 and they serve to show the extent of applicability of such data as shown in references c and d.



	Vis.	Gravity A. P. I.	Per Cent	Curves
Viscuous Neutral	450	24.5	26	(4)—(2)
Neutral	150	26.6	32	(3)—(2)
Non-Viscuous Neutral	75	28.0	20	(3)—(2)
Gas Oil		32.8	22	(3)—(2)
			100	
Viscuous Neutral	300	25.3	44	(4)—(2)
Neutral	100	27.4	25	(3)—(2)
Gas Oil		31.5	31	(3)—(2)
			100	
Viscuous Neutral	220	25.8	58	(4)—(2)
Non-Viscuous Neutral	75	28.0	20	(3)—(2)
Gas Oil		32.8	22	(3)—(2)
			100	

The above analysis is quite satisfactory for those materials not containing a tarry bottoms, but a crude oil could not be so handled. Crude oil, reduced crude, residuums, etc., should be distilled or topped, eliminating a heavy tar





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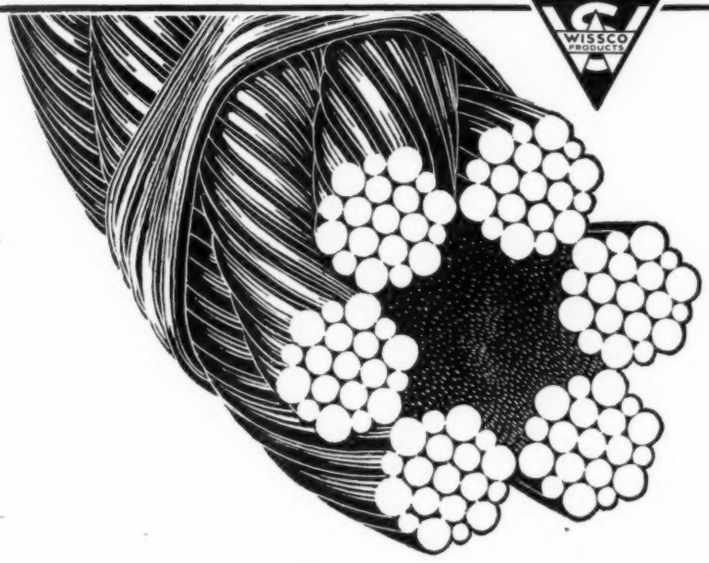

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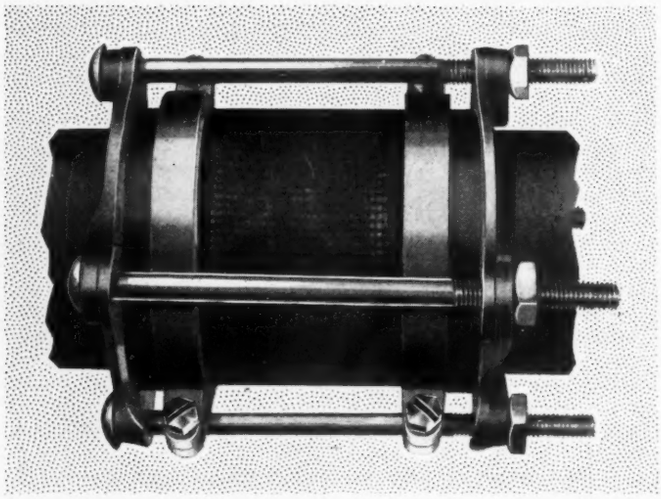

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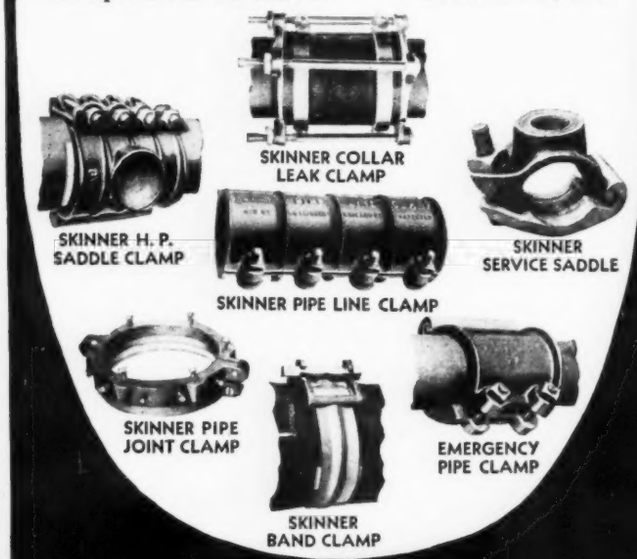

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of 6-10 A. P. I. before the analysis described above is conducted.

The Base of an Oil

Such an elaborate analysis cannot be followed for every design problem, hence we find it useful to correlate such information as we have. As a general grouping, the crude oils may be classified as (1) paraffin base, (2) mixed base, (3) hybrid base, and (4) naphthene base. To most engineers the base of an oil connotes certain distinctive properties. As an aid to determining the base of an oil the following indications may be helpful:

(1) The Bureau of Mines "Key Fraction No. 1"[d].

This fraction boils between 482° F. and 527° F. If the gravity of the fraction is above 40 A. P. I., the oil is paraffin base. If the gravity is 33 A. P. I. or lower the oil is naphthene base.

(2) The Bureau of Mines "Key Fraction No. 2"[d].

This fraction boils between 527° F. and 572° F. at 40 mm. pressure. If the cloud point of this fraction is below 5° F. the oil contains no wax and is definitely naphthenic.

(3) Crude Gravity Versus Gasoline.

Plotting the percentage of 415°-420° F. E. P. gasoline against the A. P. I. of the parent crude oil, gives well-defined zones for the various bases of oil. Such a diagram, which was prepared from 130 crude oil analyses, is given in Figure 2.

(4) The Viscosity-Temperature Relationship.

Reference should be made to the succeeding paragraphs dealing with the correlation of crude oil properties. The curves relating viscosity and B. P., also indicate the viscosity-temperature relation between raw crude oil cuts. Recently this relationship has been generalized by a factor, the viscosity index, which is presented by Dean and Davis of the Standard Development Company. The viscosity-temperature relation is the best indication of the base of an oil. In fact, the base of an oil has almost been dominated by this relationship since the viscosity-temperature relationship is the factor by which superior oils are selected.

(5) Comparison of the Physical Properties With Those of Oils of a Known Base.

The Correlation of Crude Oil Properties

Figure 3 is a comparison of the boiling ranges of crude oils. The correlation was obtained from 82 true boiling point analyses of crude oils. The material boiling up to a T. B. P. cut point of 450° F. and called gasoline, was plotted as 100 per cent and the remainder of the crude oil, or what may be termed the base, was also plotted as 100 per cent.

Figure 4 presents a comparison of viscosity at both 100° and 210° F. for the various crude oils.

Figure 5 is a correlation of crudes by gravity.

Whereas crude oil is extremely divergent in character so that freak oils are often encountered, the above correlation can be used only as a generalization. Nevertheless, such a correlation does provide one more indication of the nature of the truly complex raw material—crude oil.

References:

(a)—Leslie & Good—Journal Ind. Eng. Ch. April, 1927.
(b)—Piroomor & Beiswenger—A. P. I. Proceedings of 9th Annual Meeting, 1929.
(c)—Beiswenger & Child—Atlanta Meeting Am. Chem. Soc., 1930.
(d)—N. A. C. Smith—Reports of Investigations Bureau of Mines, Serial No. 2806.

Gas Convention to Be Held in Memphis, May 11 to 14

THE Natural Gas Department of the American Gas Association will hold its Annual Meeting at Memphis, Tenn., May 11 to 14. Headquarters of the convention will be at the Peabody Hotel. The meeting will open with an address of welcome by the Honorable Watkins Overton, Mayor of Memphis, and will be composed of many technical and practical committee gatherings, dealing with every phase of natural gas. An excellent attendance is anticipated.

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NEILAN CO., LTD., 641-651 Santa Fe Ave., Los Angeles, Calif., has issued two new bulletins. Bulletin No. 207-B, describes the company's ball bearing, multiple spring excess pressure relief valve No. 207, designed for maintaining a constant upstream or back pressure whether installed in steam, air, water or other fluid lines, by automatically relieving any excess. Bulletin No. 206-B is a descriptive article on Neilan ball bearing, multiple spring reducing regulator No. 206. This regulator has been designed for reducing service where a constant outlet or service pressure is desired.

KEROTEST MANUFACTURING COMPANY of Pittsburgh, Pa., has issued a new Kerotest catalog, a most complete catalog of valves and fittings for the oil field and the refining industry. The material is well presented and includes many actual photographs of installations in various parts of the world, in addition to specifications and descriptive matter.

"THE ECONOMICAL RIG-POWER METHOD of Pumping Wells" is a bulletin just published jointly by the Producing Equipment Company (James R. Cole), Tulsa, Okla., and Oilfield Equipment Company, 30 Church Street, New York City. This illustrated booklet explains in detail the results obtained by converting a standard rig into a balanced 2, 4 or 6 well rodline power for pumping average jack wells up to 3,500 feet deep or one additional well of any depth and weight that a rodline can pull. The bulletin may be obtained by writing either of the above named companies.

THE REED ROLLER BIT COMPANY, Houston, Texas, is now sending out to its entire mailing list an unique type of catalog, covering all of the articles of their manufacture, together with prices thereon.

This catalog has just come from the press and fully explains all of the improvements recently made on their rock bits, reamers, core bits, wire line bit and Barrett-Robishaw drilling-coring bit.

The Reed Roller Bit Company advises that additional copies will be mailed to those interested.

THE ELECTRIC CONTROLLER & MFG. CO., of Cleveland, Ohio, has published a new pamphlet, entitled "Where Control Must Not Fail." The illustrated pamphlet describes the use of automatic starters and controllers in many industries.

"ELEMENTS OF CHEMICAL ENGINEERING," by Badger and McCabe, has been published by the McGraw-Hill Book Co. The clear and concise methods of presenting the fundamental conceptions and the elucidation of the mathematical methods useful in solving engineering problems make the book a very valuable reference for the petroleum engineer. The excellent presentation of such subjects as Flow of Fluids, Flow of Heat, Transportation of Fluids, Distillation, Gas Absorption and Filtration will appeal to the chemist or engineer whether he is engaged in the refining, transportation or production branch of the industry. Price $5.

A FINELY BOUND, neatly prepared catalog of rotary and standard cable tools has been issued by the Hinderliter Tool Company of Tulsa. The book has 275 pages, is well illustrated, and printed on high grade of paper.

In the preparation and presentation of this issue the company succeeded in making it complete in every detail.

THE BRADFORD MOTOR WORKS of Bradford, Pa., and Tulsa, Okla., has issued a new catalog on the B. M. W. products. This company manufactures pumping equipment, having been in the business since 1911.

To those interested in pumping equipment and parts this new catalog will be especially interesting. It is well printed and illustrated. The catalog may be obtained by writing the company.

M. B. SKINNER COMPANY, South Bend, Ind., has just received from the press its No. 31 catalog, showing all of the company's present products. The catalog introduces a new extra large size emergency pipe clamp made up to 48-inch size and in various lengths up to six feet. It is a complete treatise on pipe repairs and may be secured by writing to the Skinner company.

THE LUFKIN RULE COMPANY, with main offices and factory in Saginaw, Mich., has published two interesting catalogs that will be sent to those requesting copies. The catalogs are the company's General Catalog No. 11 and a Precision Tool catalog referred to as No. 6.

Products described and illustrated in these are all kinds of measuring tapes, steel and woven; folding rules of Aluminum, wood, steel, etc., and machinists' tools. Besides these products the company makes gauging tapes, including those equipped with plumb bobs; tank strapping tapes; steel and woven tapes for general measuring; stainless steel tapes; spring joint wood rules; folding boxwood rules; folding aluminum rules; micrometers; calipers; dividers; combination squares; steel scales; and gauges for depth, center, screw pitch, radius, surface, etc.

THE STANDARD INSPECTION LABORATORY of the Standard Oil Development Co. has issued a pamphlet describing standard reference fuels "A" and "B," together with five curve sheets giving the calibration of these fuels in terms of octane numbers made in this laboratory.

Standard reference fuels "A" and "B" are secondary reference standards for use in conducting knock rating tests. The reference fuels are straight run gasolines with physical characteristics suitable for long-time storage. As a precautionary measure, however, their anti-knock value, aniline point and vapor pressure are periodically checked to detect any changes that may take place.

The octane number of a fuel is defined as the percentage of iso-octane by volume in the mixture of iso-octane and normal heptane required to match the anti-knock value thereof. Although these pure compounds may be run in the engine, their high cost prohibits their use for routine testing.

It is expected that users of standard reference fuels "A" and "B" will add anti-knock materials to these fuels and calibrate the resulting mixtures in terms of octane numbers by their own methods of test. Octane numbers so obtained on a given fuel may vary with different makes of test engines and with different methods of testing.

Requests for additional information on these fuels should be sent to Standard Oil Development Company, attention Ross H. Dickson, Room 734, 26 Broadway, New York, N. Y.

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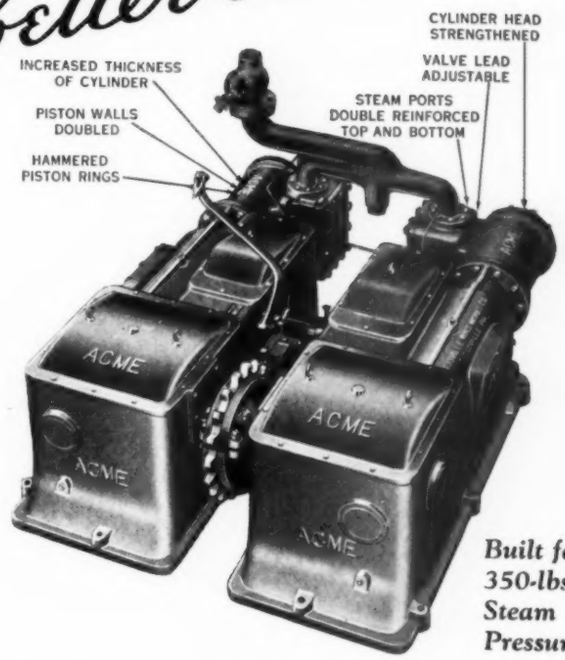

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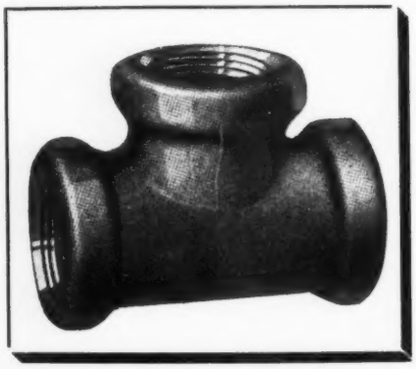

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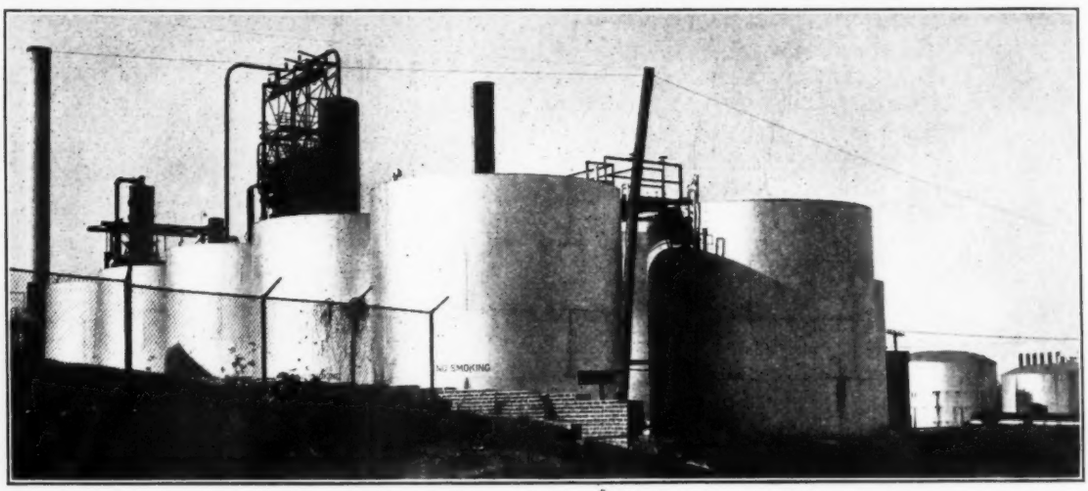

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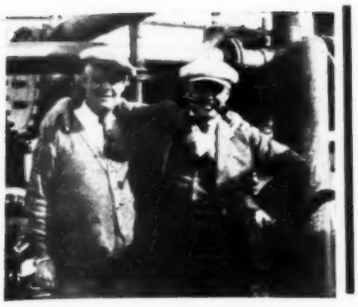


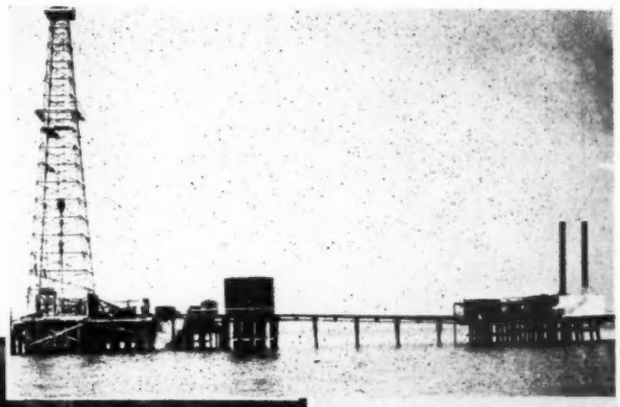
R. L. Jones (left) with The Broderick Co. and A. H. Carson, factory representative for Ajax Iron Works, who installed the equipment.

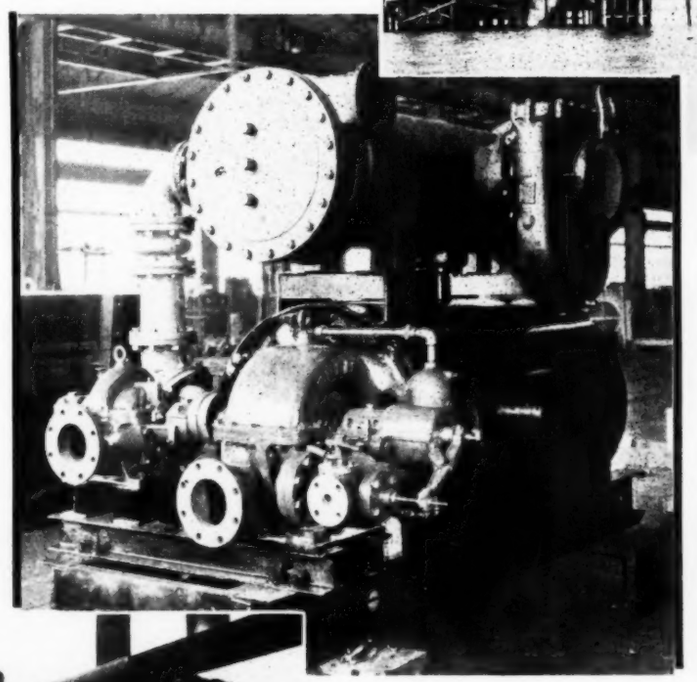
Method of Eliminating Boiler Troubles Caused by Salt Water with

Portable Condenser Unit for Drilling

DRILLING a well on the fringe of the Gulf of Mexico is a job replete with difficulties peculiar to that region. This applies in particular to wells drilled south of Houma, Terrebonne Parish, Louisiana. In this area many wells are from 20 to 60 or more miles from a base of supplies. Curiously enough, though accessible only by water, obtaining a supply of water suitable for steam-raising purposes at the well is a serious problem.

Bay water for use in a steam boiler without treatment is out of the question because of its high salinity. Well water usually is just as objectionable for the same reason. Water barged from a distant source of fresh water supply usually is resorted to. But this is expensive and the cost may run as high as 25 cents per barrel. Also, adverse weather may interfere to cause long delays. The question of how to cut down enormous boiler repair bills has engaged the attention of operators for some time. Condensing equipment at the well has always seemed to point to a satisfactory solution of the problem, and various types have therefore been tried.

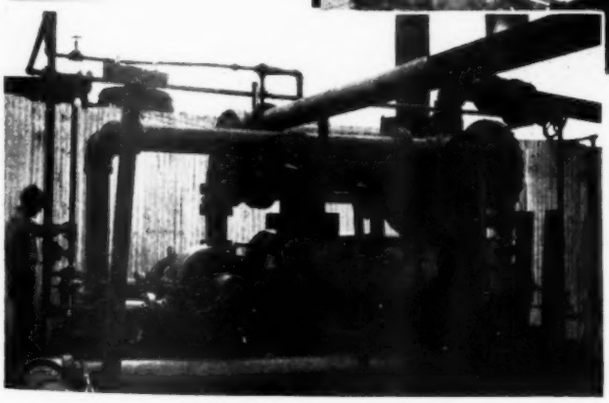




Top—Well of the Texas Company on Lake Barre dome, south of Houma, La., which was equipped with steam condenser.

Right—View showing compactness and sturdy mounting of unit.

Below—Exhaust steam condenser for rotary drilling rig.



Most of these have consisted chiefly of a set of shop-made condenser coils submerged 12 to 15 feet in the bay, and those tried have met with indifferent success. This type appears to have two serious defects. First, it creates too much back-pressure on engines and pumps. Second, the severe service conditions cause frequent coil leaks, and, as the coils are awkward to get at, repairs are difficult and expensive to make. A coil leak allows bay water to be drawn into the condenser. This water finds its way to the boilers, where it causes serious trouble. In addition, the capacity of the condenser is reduced and all the exhaust steam cannot be handled, hence the amount of boiler feed make-up is increased.

After a thorough study of actual field conditions and requirements, Ajax Iron Works, Corry, Pa., and The Broderick Company, Muncie, Ind., together designed a

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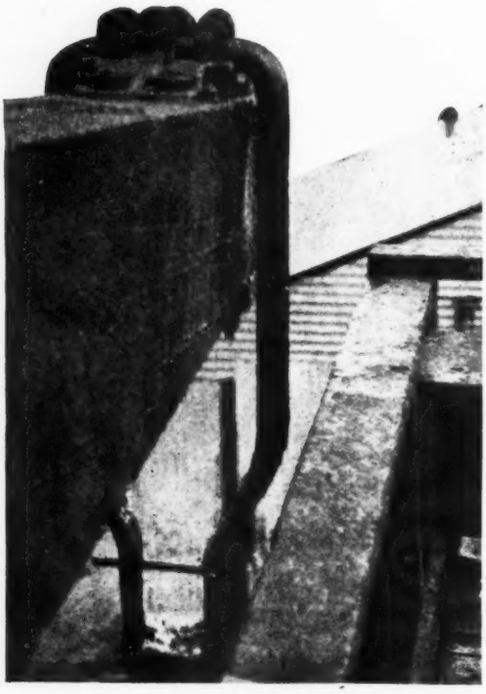

Ratigan No. 39 Pitman Stirrup Bearing

This Stirrup Bearing is installed and used in place of common hardwood. It provides a long-lived bearing that eliminates friction and troublesome changing of hardwood blocks. The oil reservoir is sufficient to lubricate bearing for several days' run. Simple to install, maintenance negligible—and its initial cost is insignificant. Write for catalog.

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portable condenser unit for steam-driven rotary drilling outfits. The first one tried in the field has shown remarkably successful results. It was installed and put into operation early in February, this year, at a well of The Texas Company on the Lake Barre Dome, near Houma, La. Placed on the platform alongside the boilers, no extra piling was required for its installation.

The condenser is designed to handle 17,000 pounds steam per hour. The circulating pump, driven by a 15-horsepower steam turbine, has a capacity of 950 gallons per minute. A hot-well tank, which is part of the unit, placed below the condenser (see accompanying illustrations), has two Fisher liquid level controls, one for removing excess liquid, the other for maintaining a sufficiency of liquid, making the control automatic. There is also an oil strainer on the exhaust steam inlet to the condenser. An evaporator also comprised part of this unit. It has a capacity of 4,270 pounds water per hour at a pressure of 70 pounds per square inch. At 30 pounds pressure, however, the evaporator made enough fresh water for all fresh-water requirements, including make-up water for the boilers and an ample supply for the drilling crew's uses.

On this well, which was completed as a producer at about 3,600 feet, a 12 by 12 Ajax twin steam engine, 14 by 7¼ by 14 mud pumps and two 285-horsepower, 250-pound working pressure Broderick boilers were used. Gas fuel was used at the boilers. The condenser unit is sturdily mounted on steel skids.

A hot-well temperature of 170 degrees F., with a circulating water temperature of 65 degrees F. and an average temperature rise of 40 degrees F., were obtained on this test. Although detailed test data are not yet available, it is reported that there was an absence of boiler troubles and consequent shutdowns. It is claimed that this is the first well drilled under the conditions found in this area that was relatively free from boiler troubles where steam power was used for drilling.

Hughes Tool Co. to Market Brown Safety Tubing Head

THE Hughes Tool Company has announced the acquisition of manufacturing and marketing rights to the Brown safety tubing head, previously manufactured by the Gray Specialty Company, Houston, Texas.

The Brown safety tubing head, which permits full operation of the master gate after the well has been tubed, was developed and patented by C. C. Brown, Houston, and has enjoyed the favor of the industry.

Hereafter this equipment will be known as the Hughes-Brown safety tubing head. The Hughes Tool Company, Houston, Texas, will furnish further information upon request regarding its new product.

Foster Wheeler Now Makes Boilers

THE Foster Wheeler Corporation announces its entry into the field of boiler manufacture and is prepared to furnish all types in the entire range of sizes. The plant of the D. Connelly Boiler Company of Cleveland, Ohio, has been acquired by Foster Wheeler, affording complete facilities for boiler manufacture.

Kerotest Appoints Mid-Continent Service Agents

KEROTEST MANUFACTURING COMPANY, Pittsburgh, Pa., has appointed the Cameron Iron Works, Houston, Texas, and the Brauer Machine & Supply Company, Oklahoma City, Okla., as its field service agents. The Cameron Iron Works will handle all service accounts of Kerotest Valve in the state of Texas, while the Brauer company will give similar service in the state of Oklahoma.

Landing a Casing String Weighing 230 Tons

ONLY recently another record was established in running and landing a long string of casing. In the Blauvelt well of the North American Oil Consolidated Co., section 36-21-17, North Dome, Kettleman Hills field, California, a string of 13⅜-inch seamless steel 68-lb. casing, almost one and one-third miles long, and weighing 230 tons (short tons), was landed and cemented in a total elapsed time of about 21 hours. This is the longest string of 13⅜-inch casing ever run in a well. The fact that the job was done without a hitch speaks well for the condition of the hole. Care, together with the equipment used in drilling, has resulted in a remarkably straight hole, which is not more than two degrees off vertical at any one point, and the general average of the readings was much less than this.

Casing was landed at 6766 feet in 18¾ hours. The placing of the cement, 850 sacks, was completed in slightly over two hours by the Perkins two-plug process. Two cement collars, one on bottom and one on first joint, were used to float the string in. A special cement whirler shoe was also used on bottom of the casing. It required a final pressure of 775 lbs. per square inch to place the plug.

Seamless casing of grade "D", A. P. I. Specifications was used, having a tensile strength of 95,000 lbs. per square inch. Joints of 42-ft. average length were employed and facilitated running of the casing.

Careful control was exercised in lowering the casing and the total weight kept under close observation by weight indicator.

Besides the string of 13⅜-inch, there is 1381 ft. of 18⅝-inch 84½-lb. casing in the well. The hole was drilled by hydraulic rotary method to 6766 feet when the 13⅜-inch was run. It is planned to carry this well as deep as necessary, which may be well below 10,000 feet, if no trouble arises. At about 8400 feet it is proposed to land a string of 9-inch seamless casing.

This is a remarkable tribute to the methods and equipment employed on this well.

A. S. M. E. Petroleum Division Plans Active Program

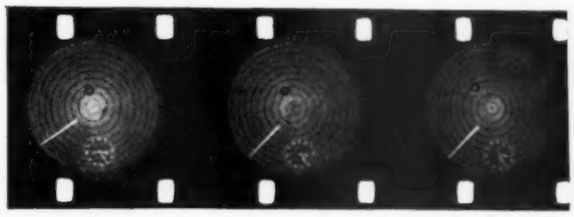
THE Petroleum Division of the American Society of Mechanical Engineers is now planning an active program for the year 1931 and first half of 1932. In arranging the program every effort is being made to bring together members of the various groups and provide an outlet for discussion of activities and developments in the field and to co-operate with other groups and fields closely related to the petroleum industry.

On May 5 and 6 a symposium on refining will be held at Elizabeth, New Jersey. The final program for the meeting will be announced shortly. In addition to conferences, visits to nearby plants are contemplated.

The Lubrication Engineering Committee is planning co-operation in a one-day Lubrication Meeting at Pennsylvania State College, May 22.

Technical sessions are being considered for the Kansas City regional meeting in September and at the annual meeting in New York in December. In May, 1932, we expect to hold another national meeting in Tulsa during the International Petroleum Exposition. An auditorium especially designed and located for technical sessions, is to be finished at that time.

SURWEL ..Clinograph

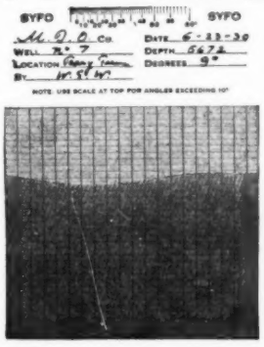


Photographs Don't Lie

It pays to discover the truth about a non-producing well. With the aid of the gyroscope we have been able to make an instrument which will not only accurately tell the degree of deviation but the exact **direction** of it. The SURWEL Gyroscopic Clinograph has been subjected to exhaustive field tests over a three-year period. The service is now available to operators to make complete and accurate surveys of wells in the shortest space of time.

SYFO Clinograph for Surveying Drilling Progress

The presence of crookedness in drilling is not indicated by any clear-cut evidence. Well owners today insist that the hole be surveyed as it is drilled. For such the SYFO affords a direct and accurate record — on paper — and without the use of dangerous acids. It is easily and quickly operated. We will be glad to send descriptive literature.



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SYFO .. Clinograph

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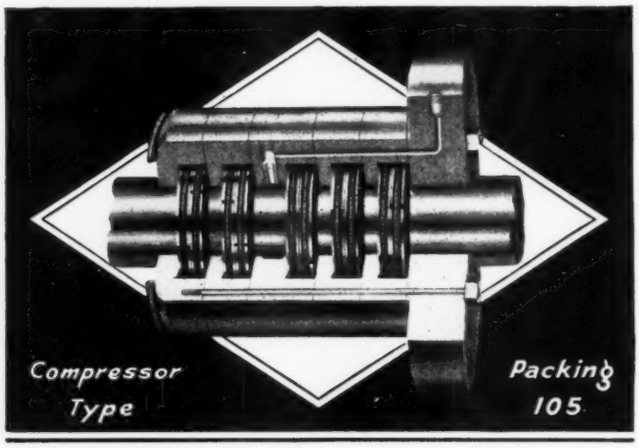
COOK'S GRAPHITIC IRON ROD PACKING

FLOATS WITH THE ROD



ELIMINATING THE THIRD BEARING

IN a reciprocating unit the angular thrust of the connecting rod is absorbed by the crosshead bearing. The cylinder acts as a bearing in carrying the Piston. These two bearings must be kept in perfect alignment else the interposed packing will act as a *third* bearing on the rod.

Perfect alignment is disturbed by wear, unequal expansion, faulty adjustment and vibration, any one of which causes a non-floating packing to act as a bearing. As this condition develops, friction increases, rod and packing wear is accentuated, and the packing leaks.

This trouble is completely eliminated in COOK'S Floating Metallic Packing as its design allows the packing rings to float with the rod. There is an improved type for all Air, Gas and Steam conditions.

Then, too, the wearing rings are made of Graphitic Iron, an exclusive material that aids in eliminating friction, and provides added years of service.

These exclusive features are being appreciated more and more as evidenced by the ever increasing use of COOK'S Packing by the leading operators in the oil and gas fields.

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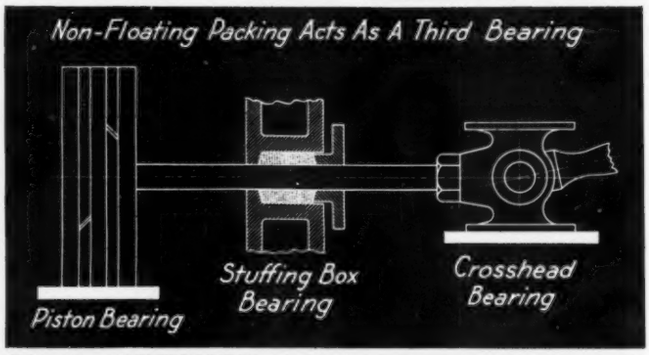

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Large Attendance Expected for Gasoline Association Convention

A large attendance is expected for the tenth annual convention of the Natural Gasoline Association of America which will be held May 19-21 at the Mayo Hotel, Tulsa.

In addition to attending to the regular business of the annual meeting a number of papers on timely subjects will be read by prominent men of the natural gasoline division of the industry. These papers will be discussed following their presentation. A tentative program follows:

TUESDAY, MAY 19, 1931. (*Morning Session.*)

Opening Session—10:30 A. M.

Welcoming Address—Frank L. Chase, Lone Star Gas Co.

President's Address—Dr. E. R. Lederer, Texas Pacific Coal & Oil Co.

Appointment of Nominating Committee.

Report of Active Standing Committees.

Afternoon Session.

Prepared Economics Round-Table Discussion.

Mid-Continent:

1. "Production and Transportation of Natural Gasoline"—F. E. Rice, Phillips Petroleum Co.
2. "The Natural Gasoline Situation from the Standpoints of the Natural Gas Pipeline and Carbon Black Manufacture"—W. E. Reardon, Columbian Gasoline Corp.
3. "The Marketing Outlook for Natural Gasoline"—D. E. Buchanan, Hanlon-Buchanan, Inc.

California:

1. "Production, Transportation and Markets of Natural Gasoline in California"—W. W. Robinson, Jr., The Texas Company.

WEDNESDAY, MAY 20, 1931. (*Morning Session.*)

1. "New Developments in Plant Processes and Equipment"—G. M. Davidson, Empire Oil & Refining Co.
   Discussion by E. A. Wooden, Sinclair Oil & Gas Co.
2. "Plant Management Kinks"—Jack Power.
3. "The Disposal of Residue Gas"—D. C. Williams, Continental Oil Co.
   Discussion by D. A. Sillers, Lone Star Gas Co.

Afternoon Session.

1. "A Resumé of the New Specifications for Natural Gasoline"—R. C. Alden, Phillips Petroleum Co.
   Discussion by Dr. George G. Brown, U. of Mich.
2. "Fractionation Control"—S. S. Smith, Shell Petroleum Corp.
   Discussion by W. G. Hiatt, Phillips Petroleum Co.
3. "The Kettleman Hills of Today"—C. R. Burgess, Standard Gasoline Co.

THURSDAY, MAY 21, 1931. (*Morning Session.*)

1. "The Status of the Liquefied Petroleum Gas Industry"—G. G. Oberfell, Phillips Petroleum Co.
   Discussion by W. G. Watkins, Skelly Oil Co.
2. "Motor Fuel Developments"—Dr. George G. Brown, University of Michigan.
   Discussion by G. G. Oberfell, Phillips Petroleum Co.

Afternoon Session.

1. "The Refinery, from the Natural Gasoline Man's Viewpoint"—Emby Kaye, Skelly Oil Co.
2. "The Determination of the True Vapor Pressure of Liquids and Its Value to the Petroleum Industry"—E. J. Squire, Shell Petroleum Corp.
3. "Vapor Recovery in the Refinery"—Speaker to be selected by the Western Petroleum Refiners' Assn.

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Meeting of A. P. I. Division of Refining Featured Motor Fuel Research

Motor fuel and refinery engineering were the chief subjects considered at the first mid-year meeting of the Division of Refining of the American Petroleum Institute, held in St. Louis, Mo., April 15 and 16. However, reports from committees representing the Federal Oil Conservation Board and the Institute's estimates of production and consumption of crude and refined petroleum products were also stressed.

Committees and sub-committees of the division held scheduled meetings, some groups convening in advance of the general session for the purpose of furthering co-operative work in the study of refining problems and to discuss and prepare reports for the general meeting on various problems of refining methods.

The session of April 15 was given over largely to a study of the work on motor fuel research being conducted at the U. S. Bureau of Standards under the auspices of the Co-operative Motor Fuel Research Committee sponsored by the petroleum and motor industires and the United States government.

Thursday's sessions were of special interest to the refinery engineer, the program dealing with consideration of alloy steels for high temperature service, fire protection and waste disposal.

R. C. Holmes, president of The Texas Company, presided at both sessions as Chairman of the Division.

Cooper-Bessemer Has New Agencies

TWO agencies for distribution of Diesel engines have been appointed by Cooper-Bessemer Corporation, Mt. Vernon, Ohio, according to a recent announcement. One is the Pacific Marine Supply Company of Seattle, Wash., and the other Hoffers, Ltd., of Vancouver. The Seattle organization will serve Washington, Oregon and Alaska from offices in Portland, Astoria and Ketchikan, Alaska. The Hoffers organization will act as agents throughout British Columbia and British Yukon.

American Iron & Machine Opens East Texas Shop

THE American Iron & Machine Works Company is establishing a shop at Kilgore, Texas, to serve the East Texas oil field. It will be well equipped and efficiently operated. The machine shop formerly maintained by the American Iron & Machine Works Company at Maud, Okla., has been discontinued.

Correction

OUR attention has been drawn to an omission which may have caused many of our readers some difficulty in interpreting the curve, Fig. 2, which appeared on page 118, February (1931) issue of The Petroleum Engineer under the article, "Analytical Consideration of Drilling Muds." The ciphers were inadvertently omitted from the numerals on the axis of ordinates showing "Barrels Produced Per Ton of Dry Mud." This vertical scale is logarithmic and three series of numbers from one to nine are shown. The first series is from one to 10; the second series from 10 to 90, and the third series from 100 to 500. We hope this will clarify the information the curve was intended to convey.

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If this Housing ever Breaks or Distorts we will replace it Free
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THE wrench with the plain-spoken guarantee—no more housing breakage, no more bother or expense of housing repairs. Break or warp the housing and we replace it free.

And you'll get wrench performance you never met before. Instant grip, instant let-go—with no slipping and no locking on the pipe. A stout I-beam handle that makes your hardest pull comfortable to your hand. Adjusting nut that turns easily in wide open housing.

And these: easily renewable heel jaw; full-floating hook jaw that won't bend or break, with accurate pipe scale on it; handy hang-up hole in handle; rubber grips for 10″ and 14″ sizes.

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Try a RIDGID and you'll realize what an advance has been made in pipe wrench construction. Your Supply Store or Wholesaler has RIDGIDs.

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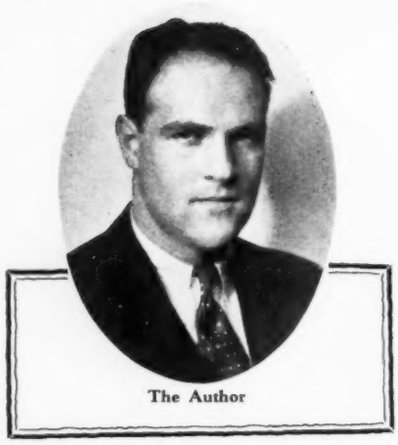


The Author

Types *and* Uses *of* Lubricating Devices

By

H. R. MATHIAS, *Lubrication Engineer*

IN a previous article on this subject, the statement was made that successful grease lubrication depends upon three factors: (a) skillful choice of product, (b) quality of lubricant chosen, and (c) proper method of application. It should be emphasized that these three cardinal factors are interdependent. Without choice of a quality product suitable for the service at hand, the finest lubricating device that money can buy will fail or, at least, be seriously impaired in its efficiency. Conversely, an excellent lubricant may fail because of improper application. These facts should be kept in mind throughout the following discussion.

A lubricating device should be so designed that the lubricant required can be applied (1) at the right time, (2) in an amount sufficient to provide lubrication without waste, and (3) in the right place. A system which fails in any one of these three requirements will fall short of its purpose, regardless of the lubricant used. If a device should be so constructed that the feed of lubricant cannot be controlled, it is likely to prove wasteful. If a device will not place the lubricant in the correct place in the bearing, it represents money unwisely expended, for lubrication difficulties will certainly arise. Lastly, it is obvious that if the lubricant is not fed when required, results from the device will be of little, if any, benefit over hand application.

An extremely dirty bearing. Illustration courtesy S. F. Bowser & Co.

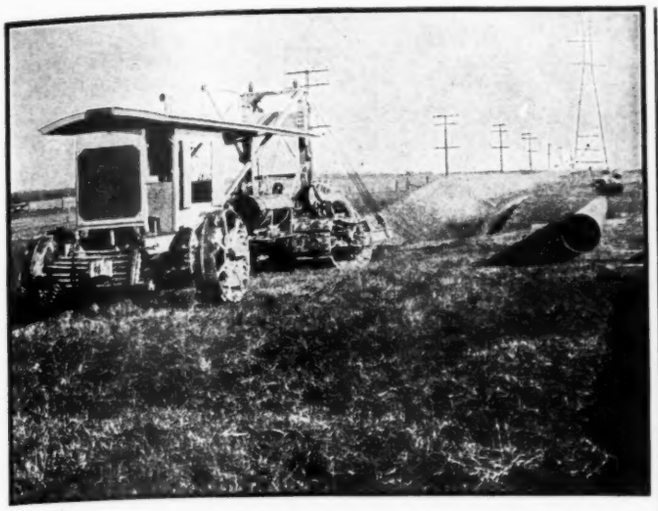
Machine builders are designing and equipping their products for such effective lubrication that little thought need be given to application other than choice of a suitable lubricant.

As far as oil lubrication is concerned, for several years we have had a number of devices available for use in case of application difficulties; such devices, for instance, as bottle oilers, wick feed oilers and mechanical force feed oilers. Previously instruments for handling greases had been limited almost entirely to grease cups or pressure guns and fittings. Proper application of greases was therefore difficult in all cases. Fortunately, this condition no longer exists. There are now numerous satisfactory devices, including full automatic pressure feed systems. Their use is rapidly becoming more general with resultant economy and excellence of lubrication.

Instruments for applying grease may be divided into two general classes: (a) gravity type, and (b) pressure type. The gravity type includes pin cups and drip cups for fluid greases. Pin cups are similar in operating principle to bottle oilers, the slight eccentricity of the shaft in the bearing on which the pin rides giving them a perceptible pumping motion which feeds the grease. The use of pin cups is obviously restricted to very soft greases and can be used satisfactorily only where temperatures are fairly constant. For obvious reasons pin cups should not be used for ball or roller bearing lubrication, nor upon a shaft in which there is a keyway or groove. They are of value for shafting lubrication in textile mills and other places where drippage of lubricant may prove disastrous to the product and where a limited amount of grease is required. They are not applicable for use on reciprocating bearings, on vertical bearings or where vibration is severe.

Attempts have been made to use wick feed oilers for application of fluid greases. The filtering action of the wick, however, defeats its utility, for, almost invariably, the oil is extracted and the soap left behind if, indeed, the grease will feed at all.

The most common gravity feed method of lubricating bearings is that of placing the grease directly in contact with the rotating journal. In a great many mills, such as paper, cement and steel, journals are still lubricated in this way. It must be admitted that in many such cases a change to some lubricating device would prove of no benefit whatever. In others, a system of some kind would greatly



Heavy-duty Buckeye Model 48 Pipe Liner. Cuts 6 different widths —22" and 40"; any depth to 8½'. All dimensions inclusive.

OVER 30 YEARS' SUCCESSFUL PERFORMANCE

proves Buckeye pipe-liners profitable investments

IN buying pipe line equipment, it should be considered from many angles. First, its ability to best serve the working requirements of the purchaser. Second, how long it can be expected to render this service efficiently. Third, its original cost and maintenance should be scaled over a reasonable period of years, so that its earning power may be judged fairly. Fourth, the reputation of the manufacturer—has he specialized in his line of equipment; and has he an established policy of square dealing?

Gauged by these sound standards, Buckeye pipe-liners are good business investments. Actual users testify that these ditchers best meet all oil and gas field requirements. Over 30 years' successful engineering and mechanical experience has tested and proved the Buckeye operating principle and construction. Consequently, its endurance and efficiency may be accepted as fact—positive assurance that your money is safely protected. Most important, our helpful interest in every Buckeye continues throughout its life.

Valuable specification and performance details, also authentic service records, are contained in our catalog, "BUCKEYE—*The Pipe Liner*". A copy will be gladly and promptly sent to any prospective pipe line ditcher owner or user upon request.

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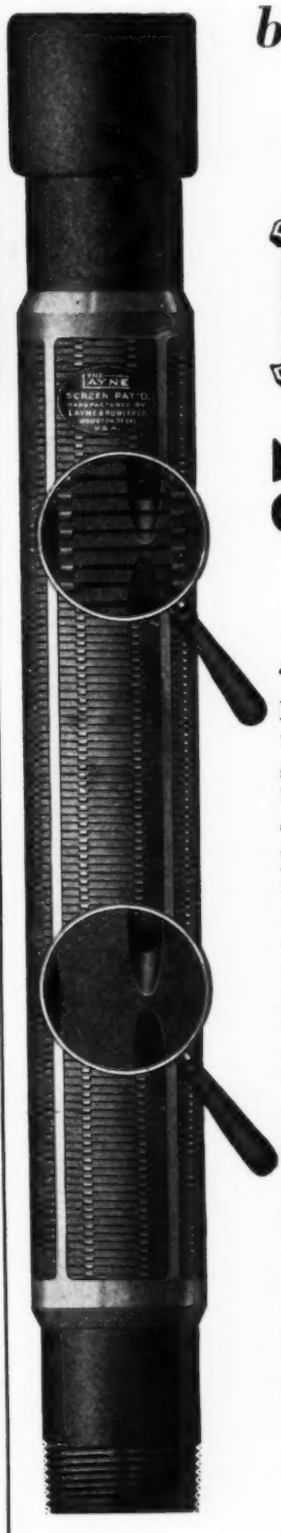
builds a screen that licks nature!



THE LAYNE MILLED GROOVE *screen*

Nature provides the oil—with some sand, mud and gas thrown in for good measure.

The Layne and Bowler MILLED GROOVE SCREEN lets nature keep her sand and gives you the oil—in abundant quantities. Twenty-five years of screen building has resulted in this improved screen which so effectively does this important job for you.

The greater inlet area of the milled groove increases production from 33-1/3% to 100%. The Keystone Wire wrapping prevents clogging and sand cutting. The two, as combined in the Layne Screen, gives you by far the most satisfactory method of solving your screening problems. Set Layne Milled Groove Screen—first—instead of wishing you had.

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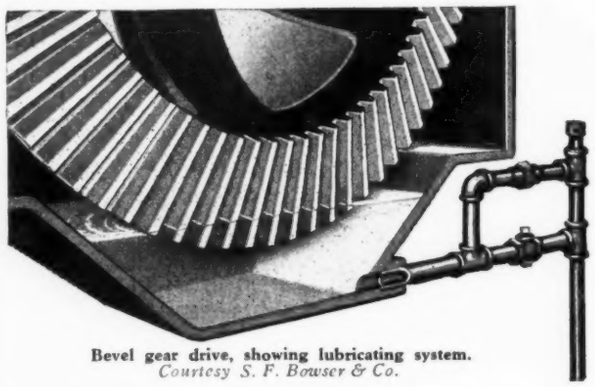
improve lubrication and reduce consumption materially. Each case must be considered individually. In order to reduce consumption and facilitate application of the lubricant, many greases made for paper, steel and cement mills are furnished in solid form. Instead of cramming the grease cavity full haphazardly, a block, cake or brick is laid on top of the journal and allowed to feed by its own weight. Sometimes consumption is so low and lubrication difficulties so infrequent that the expense of installing even the simplest device is not justified.

Among devices for supplying grease under pressure one finds a large number of systems of the non-automatic, partially automatic and fully automatic type. The familiar screw-down compression grease cup represents the most common of the non-automatic systems.



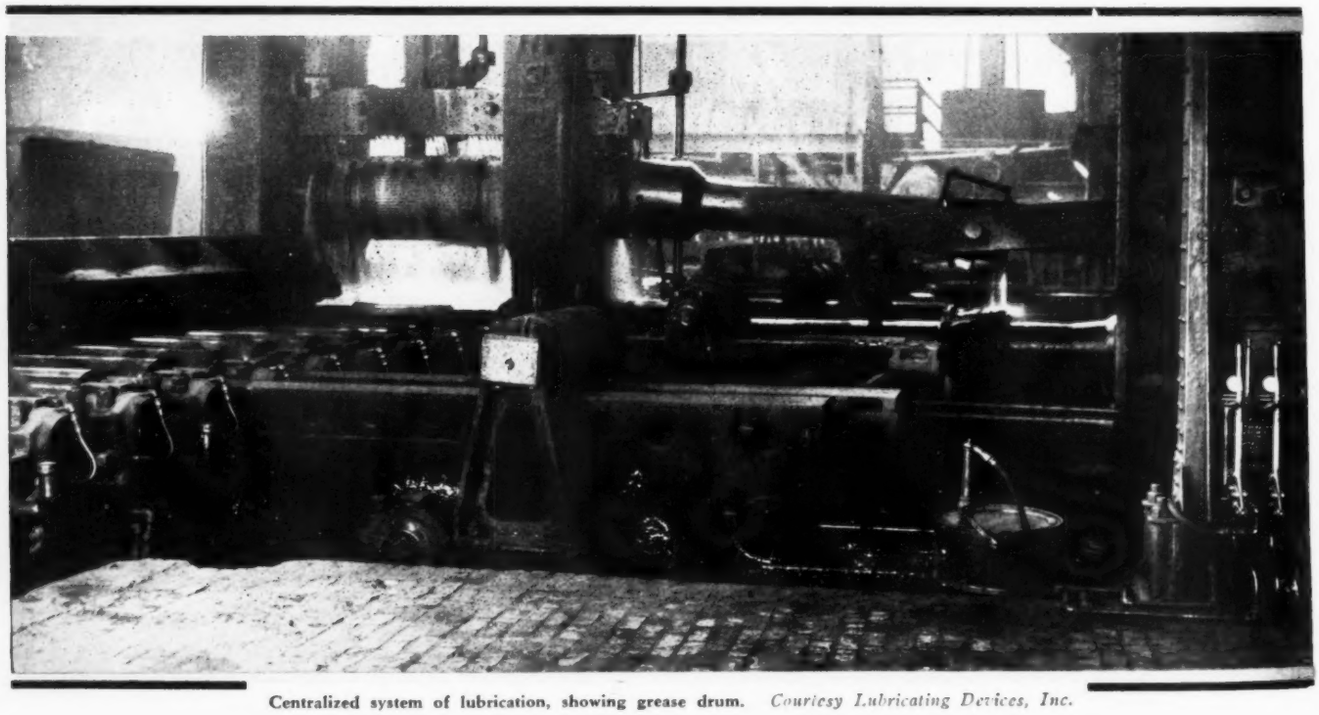
Bevel gear drive, showing lubricating system. *Courtesy S. F. Bowser & Co.*

The grease cup is especially advantageous for use on machinery having large bearing clearances and on which the use of hand oiling is found wasteful. It has, however, several disadvantages, chiefly the length of time required to fill the cups and apply the grease; the chance for contamination of the grease with foreign matter in the filling operation; and the fact that a supply of lubricant is obtained only when the cup is turned down. For the most part, bearings equipped with grease cups, because of these disadvantages, operate with insufficient lubrication throughout the greater part of their life.

Grease cups are effective if used with regularity, if the oilers understand the consequences of insufficient lubrication and the folly of over-lubrication, and if oilhouse barrels, buckets or tins of grease are protected from contamination with waste, wood chips, filings, dust, water, etc.

The limitations of grease cups soon prompted the invention and general use of pressure fittings with grease guns, many of which are now used, eliminating ordinary difficulties experienced with grease cups. With grease guns, tedious filling of cups with a paddle is avoided, as it is possible to pump the grease from the original package to the gun, thence to the bearings through the fittings without at any time exposing the lubricant. Depending, of course, upon the capacity of the gun, the number of fillings is greatly reduced. Although this system is a great improvement over grease cups, it has its defects. In the first place, as with cups, lubrication is intermittent and dependent upon a regular schedule for success. In the second place, the fittings are often heavily coated with dust or dirt, which, if not carefully wiped off before each application, finds its way into the bearings. Special care must be taken in cement and steel mills for this reason, for foreign matter common to those industries is quite abrasive.

The next improvement was the development of a partially automatic system, the spring plunger type of pressure grease cup, of which several satisfactory makes are available. The principle back of practically all makes is that a plunger is used to force grease into the bearing continuously, the plunger being operated by a spring. Cups are filled by the pressure gun. Cup capacities range from one-half ounce to 16 ounces, depending upon the make. The amount of grease fed to the bearing is regulated by use of a tension spring, the tension of which may be varied in some cases by an adjusting nut. In addition to these methods of regulating the feed, use is sometimes made of different sized plunger stems or washers. The top of the plunger rod extends above the cup and, by its position, indicates plainly when the cup needs filling. By use of such cups considerable labor is saved, for one filling lasts from one



Centralized system of lubrication, showing grease drum. *Courtesy Lubricating Devices, Inc.*

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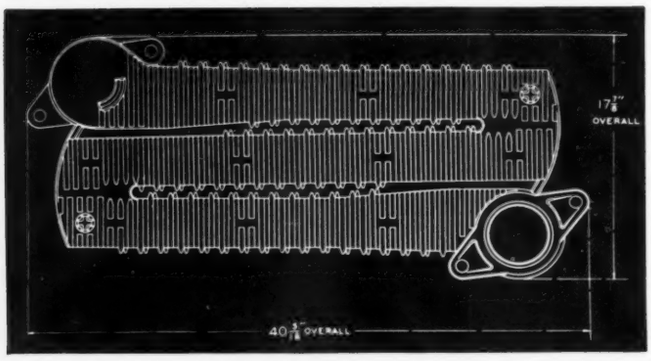
An improved Sterling Section to handle larger runs



New 3⅝" Nipple Section

For installations where the condensing coil is required to handle large volumes of vapor we have designed a new 14 sq ft. Sterling Condensing Section with thicker end walls and larger inlet and outlet openings, thereby equalizing velocities at these points, reducing pressure drops and bringing corrosion and erosion losses to a minimum.

These sections are made of corrosion-resisting ARCO METAL and continue to offer all the advantages of compactness, ruggedness and accessibility heretofore obtained by the use of Sterling Sections by refiners, large and small.

The new sections are uniform in size with the former types and can be used in the same stacks with them by using a transition section—a section having one hub machined for the new large nipple, the other machined either for the smaller nipple or for the gasket joint.

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to seven or eight days under favorable conditions. On some installations where pressure fittings formerly had to be greased three or four times a day, filling of the spring cups is necessary only once a week.

The advantages of these cups over compression grease cups and pressure fittings are apparent. However, care must be taken in their use. Good success is had when cup greases of consistency No. 3 and softer are used. Periodically cups should be dismantled and cleaned of any caked hard grease accumulated above and below the plunger. Trouble is usually encountered when attempting to apply high temperature greases, to fiber greases especially. The cup itself is not the source of the difficulty, but rather the natural springiness of greases required for high temperatures. Such products do not feed at a uniform rate, especially under varying temperature conditions having a noticeable effect on the springiness and fibre length.

Another partially automatic system which is becoming justly popular is the so-called one-shot system. Several very good types are available, each of which has its particular points of special applicability. Most of them consist chiefly of a grease compressor which forces the lubricant through pipes or tubing to measuring or regulating valves placed at each point requiring lubrication. The size of the measuring valve varies according to the needs of the bearing. The most satisfactory types of one-shot systems load the valves and discharge the grease under pressure. Several satisfactory systems are in use, however, by which the valves load by gravity or under vacuum. In order for one-shot systems to be successful, all valves must discharge lubricant at every application of the compressor. Various means are used to accomplish this, some more positive than others. In some devices the feeding plunger or the check in the measuring valve is returned to the starting position by means of a spring. In extremely cold weather or with a very heavy lubricant, the action of the spring is slow or, in aggravated cases, incapable of returning the plunger or check to the proper position. If such systems are used on equipment in exposed places, such as on ore-dock cranes, a light lubricant is necessary.

One-shot systems generally operate best on greases no harder than a No. 1 cup grease, although in some cases much stiffer greases are used. Difficulty is sometimes encountered with soap separation in the lines. If the lubricant is not so constructed as to withstand high pressure and long continued use without separation, or if high temperatures are sometimes encountered, a lubricant which will not separate soap under any conditions must be used in the system.

One-shot systems are proving very successful for lubricating a variety of equipment, especially that having many bearings. Successful installations include cranes of all types, machine tools, forging presses, shears and rolling mill table roll and roll stand bearings. They have proved very useful in reducing consumption, improving lubrication, reducing labor costs for maintenance and contributing toward safety. The latter feature is important, for the care of many bearings is hazardous because of their location. The initial cost of most systems is soon paid for by reduced cost of lubrication. One-shot systems leave something to be desired when compressors are operated manually.

Automatic systems are similar to one-shot systems with the addition of some means of mechanical operation of the compressor unit. Most automatic systems are equipped with a timing device of some kind so that lubrication is supplied at regular intervals or in an almost continuous stream if necessary. Simplicity, ruggedness and flexibility should be the guiding factors when selecting such equipment.

Editor's Note: The third and concluding article of this series will appear in an early issue.

When writing AMERICAN RADIATOR CO. *please mention The Petroleum Engineer*

Barber-Greene Company Announces Organization Changes

SEVERAL changes in their sales organization have been announced by the Barber-Greene Co. of Aurora, Ill., manufacturers of ditching machinery and material-handling equipment.

E. H. Cooper, since 1927 manager of the Barber-Greene Co. of Kansas City, has been appointed ditcher line head for the western division, to operate with J. M. Bruns, ditcher line head for the eastern division.

The territory over which Mr. Cooper formerly had charge is now divided between the Kenney Machinery Co. of 2301 Grand Avenue, Kansas City, Mo., and the Buda Engine Service, 521 West Archer Street, Tulsa, Okla.

Two new branch managers have been appointed by the Barber-Greene Co., Frank Ness having been made manager of the Philadelphia office and D. H. McLean manager of the Cleveland office.

Two Prominent Los Angeles Companies Consolidate

ANNOUNCEMENT was recently made of the consolidation of the Los Angeles Pump & Supply Company and the California Manufacturing & Engineering Company, to be known as Calmec Manufacturing Company, Ltd. General offices and plant are located at 5817 Riverside Drive, Los Angeles.

T. J. Crompton, an experienced operating man and formerly executive of one of the major California oil companies, is president of the new organization; A. S. McIntyre, former president of the Los Angeles Pump & Supply Company, is vice-president and general manager, and J. J. Ferlin is vice-president in charge of sales.

Pacific Pipe & Supply Distributor for Hydrauger

THE Pacific Pipe & Supply Company of Los Angeles has recently secured exclusive Southern California distribution of a new boring tool, the Hydrauger, which is essentially an air motor-drive auger using water as an aid in making the bore.

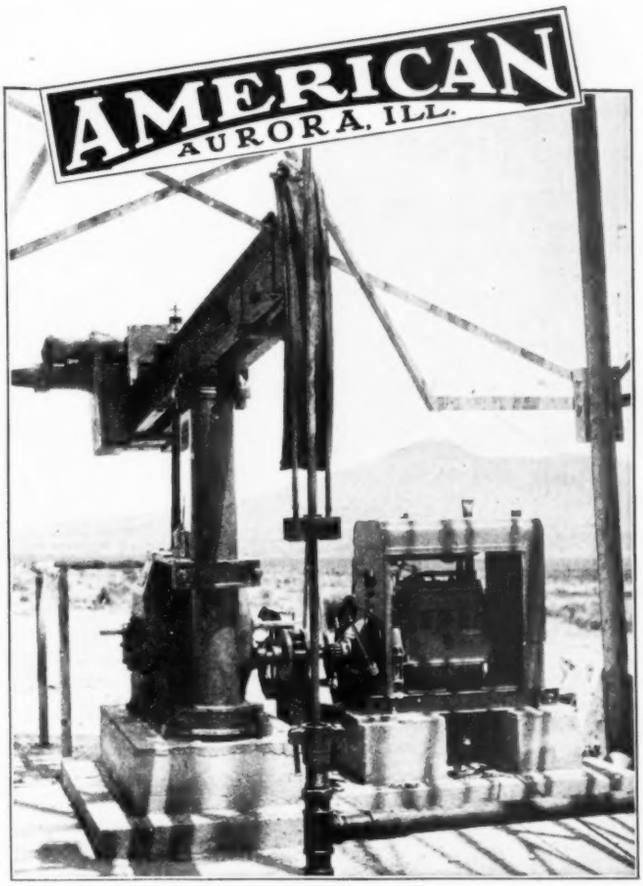
One of the chief recommendations of the Hydrauger is that, with it, the operator can drill horizontally under a street or highway without harm to the paving. Also, it may be used to advantage for digging trenches and for tunneling. At all times the direction of the bore may be controlled positively.

Lincoln Electric Moves Chicago Office

THE Lincoln Electric Company, Cleveland, Ohio, announces the removal of its Chicago office from 53 West Jackson Boulevard to a new building at 1455 West 37th Street. This move is made to provide additional space for the sales and service of Lincoln "Stable-Arc" welders and "Linc-Weld" motors, and to provide additional storage space for a complete stock of these as well as welding supplies and accessories.

International Derrick Opening East Texas Store

THE International Derrick & Equipment Company, Columbus, Ohio, is establishing a branch store at Kilgore, Texas. W. A. Jesson, formerly branch manager at Oklahoma City, has been transferred to Kilgore. Ideco is also transferring Don DeWar, one of its field engineers, to the East Texas field from West Texas.



An **"AMERICAN"** *with Gas Engine*

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"American" units have been particularly designed to meet the various drive requirements of different localities.

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CALIFORNIA » » » » Featured

THE technical meetings of several of the engineering societies were featured at the Second Annual Oil Equipment and Engineering Exposition held in Los Angeles from March 16 to 22. The oil show itself was outstanding in many respects and was larger than the first one held last year. Manufacturers spent considerable effort in arranging their displays and many moving pieces of machinery illustrated their operation under actual conditions. Demonstrations were conducted daily on the outside space.

A large number of foreign visitors were in attendance every day. One hundred special badges had been provided for the foreign oil men, but the supply was exhausted a day or two before the close of the show.

The decision was made to hold the Third Annual Exposition from February 1 to 7, 1932. Several of the exhibitors submitted petitions to hold the show over for three or four days this year and to make it a two-week show next year. The majority, however, feel that an exposition should be confined to one week.

The first of the technical meetings was held in the convention hall at the Exposition on March 17. This was the meeting of the American Welding Society and was preceded by a dinner served in the meeting room. This meeting, as planned, consisted of an open discussion of metals and welding in the oil industry. The chairman of the Pacific Coast Section, Paul E. Jeffers, consulting engineer of Los Angeles, led the discussion and presented the problem caused by fatigue failures. Locked up stresses were then taken up and instances of these in pipe line work were cited. Several differences of opinion were expressed on this subject and many valuable suggestions made for the prevention of locked up stresses in actual practice. The microscope was pointed out as one of the welder's best friends and that more attention should be given to its use. The meeting was closed with moving pictures shown by Erick Barnett, engineer for the Columbia Steel Company, giving the complete process of manufacture of steel pipe.

A "straight hole meeting" was sponsored by the American Institute of Mining and Metallurgical Engineers on Wednesday afternoon, March 18, in the meeting room. A. B. Menefee, consulting mining engineer, presided as chairman of the Pacific Coast Division. A paper on the cause and prevention of crooked holes was delivered by C. R. Dale of Dale & Nielson which gave the results of several years' observation in the surveying of oil wells. The general practices now being followed in keeping holes from deviating from the vertical and the use of instruments for indicating such deviation while the well is being drilled were described.

Alexander Anderson then gave a paper on "The Comparison of Straight Holes Drilled in 1930 With Those of Previous Years" and presented information gained from the survey of a million feet of hole in both tabular and graphical form. The improvement for the greater depths for 1931 was said to be about fifteen per cent.

Surveying instruments of recent design were presented for observation and were described. One of these employs the gyroscope and was explained by G. L. Kothny of the Sperry-Sun Well Surveying Company. Another using the magnetic compass was described by H. J. Eastman. The new automatic weight control developed by the General Electric

Exposition Engineering Meetings

Company was treated by C. E. Weaver of that company in an informal talk.

In connection with the Exposition, the California Natural Gasoline Association held a meeting at the Alexandria Hotel on the evening of March 19. The spring meeting of the Pacific Coast District of the American Petroleum Institute Division of Production was also held during the week of the Second Annual and followed a dinner at the Engineer's Club. Three papers were presented: "Recent Trends in Rig Foundations and Machinery at Kettleman," by A. F. Wilson, engineer for the Standard Oil Company of California; "The Design and Installation of Gas Traps and Vapor Systems," by R. A. March, engineer for the Shell Oil Company of California; and "Theoretical Considerations Involved in Multiple Traps and Vapor Systems," by P. S. Magruder of the General Petroleum Corporation. A. H. Bell was re-elected chairman of the district; Ralph Copley of the Standard Oil Company, "Cap" Campbell and W. F. Hertel of the Associated Oil Company were elected vice-chairmen; W. C. Corey, sales engineer for the Pacific Gear and Tools Works, was elected treasurer; and Norval White, in charge of the Pacific Coast office of the A. P. I., was elected secretary.

A most interesting meeting was held in the convention hall of the Exposition on Friday night, March 20, by the Southern California Meter Association. This was preceded by a dinner and was illustrated by slides. The first paper was read by H. N. Marsh, petroleum engineer for the General Petroleum Corporation, on the subject of "Gas Injection for Repressuring." The proper conditions for repressuring operations, the availability of gas, the regulation and control of the injected gas or air, and factors in methods to be used were all discussed.

A second paper was on the "Classification of Fluid Meter," by W. H. Davis of the Pittsburgh Equitable Meter Company. This brought out for attention many types of meters with which the oil and gas industry is not generally familiar.

The Export Meeting held in the convention hall of the Exposition on Wednesday night, March 18, was of vital interest to all the manufacturers of oil equipment who are concerned with foreign trade. Many interesting speakers brought forth the conditions affecting the use of American made equipment in foreign oil fields and indicated the good that might arise from a more concerted action by the companies that make this equipment. At the end of the meeting, a motion was made to form an Export Association. This was carried and a second meeting was called for March 25th at the same place.

The Permanent Oil Equipment and Engineering Exposition started again immediately upon the close of the Second Annual. Many of the exhibitors who had not previously displayed in the permanent, left their equipment in place for that purpose.

Stream Line Filter Rights Acquired

THE rights to manufacture and sell the Stream Line Filter in North America have been acquired by Oliver United Filters, Inc.

This novel type of filter has many unique operating characteristics. Inquiries concerning it may be addressed to Oliver United Filters, Inc., New York City.

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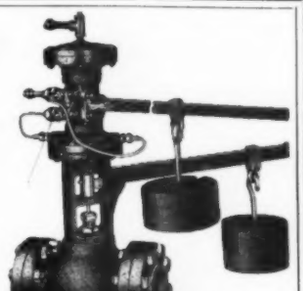

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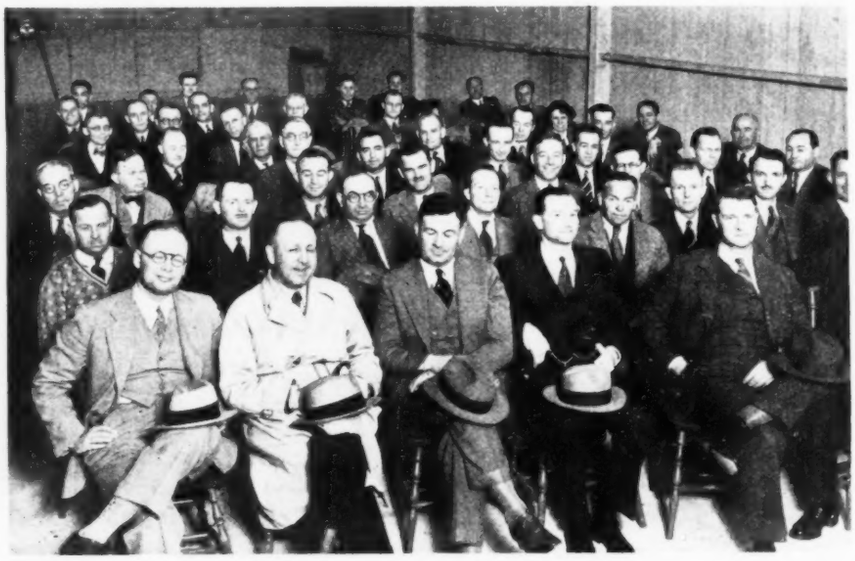
Exceptional Interest Shown in Export Association

THE second meeting of the National Association of American Petroleum Equipment Exporters was held in the convention hall of the Oil Equipment and Engineering Exposition in Los Angeles on March 25. A large group of some representatives of manufacturers was assembled and took definite action toward perfecting the organization. The meeting was presided over by W. R. Martin of Martin-Decker Corporation and was opened with a number of informal talks emphasizing the need of such an association.

L. C. Harbert with J. P. Ratigan outlined the work accomplished by the temporary committee and gave his ideas of the scope of work which should be considered by the export organization. C. Homer Spotts of McEverlast, Inc., then presented information relative to the volume of export business being conducted in the Southern California area.



Group in attendance at Export Association meeting.

In order to obtain the viewpoint of the American located in foreign fields, and who received equipment for application in those fields, L. G. Burt of Tulsa, Oklahoma, related some of his earlier experiences and brought out the fact that at one time it had been the custom of some American manufacturers to ship obsolete and otherwise unsatisfactory equipment to the foreign fields. He emphasized the folly of this practice and said that an export association could do much toward bringing about the shipment of only the best goods and, in this way, increase the good will toward American products in foreign countries.

Ray Dudley of the Gulf Publishing Company went further and stated that the American manufacturer must necessarily furnish the highest quality of equipment to the foreign buyer if he wants to increase the volume of his export business. He advised that in many foreign countries the American is imitated, but the quality of his goods has not been duplicated.

Among others who brought out the necessity for concerted action as it is being contemplated by this export association, was B. A. Cleveland of Regan Forge & Engineering Company. In order to get a more comprehensive expression from the assembly he called on J. S. Mellon of Byron Jackson Company and W. F. Huff of the National Supply Company. Both of these men have had considerable experience in the export field and offered valuable suggestions for the consideration of the association.

A motion was then made to have a committee appointed for the purpose of completing the details of the organization, the writing of the by-laws and the nomination of officers. This motion was carried unanimously and the following committee was named: W. R. Martin, chairman; L. C. Harbert, T. Sutter, B. A. Cleveland, C. Homer Spotts, J. S. Mellon and W. F. Huff. It was suggested by J. H. Tinkham of Petroleum World that assistance be rendered this committee by a discussion on the aims and activities of the association as conceived by all of the members present. This suggestion was welcomed and many valuable thoughts were presented.

The first point emphasized by several of the members was that no affiliation with any other present organization could in any way produce the results desired. The exporting of oil equipment is a specific undertaking and requires definite and continuous action. In order to achieve satisfactory results it must specialize on its objective. Mr. Spotts stated that the idea was big enough and strong enough to be carried on and that the problems must be met with the thorough knowledge that the members of the association possessed. Mr. Cleveland brought out the fact that each one would get out of it only what he had put into it, and urged that every one enter into the work of the association wholeheartedly.

The oil trade journals were represented at the meeting and all offered their hearty co-operation and every assistance possible. John Grant of the Grant Oil Tool Company brought up the consideration of problems other than export. He feels that it would pay every member to pull together rather than at cross purposes. Other members considered the treatment of other problems, but it was the consensus of opinion that the export situation required the entire attention of the association at the present time. The patent situation and the political aspects were spoken of by J. A. Dillmann of the Specialty Oil Tools Company, who felt that the association could render valuable assistance in these matters. Mr. Dudley said that many valuable data on patents could be obtained by the association and that anything handled by it would result in findings which would then be available for the use of all members. Mr. Martin felt that the influence of the organization would be desirable for obtaining better recognition of patents.

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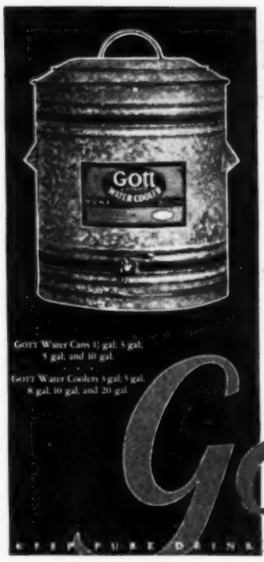

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TAG
Industrial Thermometers with NEW Snap Case-Front

SNAP . . . the case-front of the NEW TAG Industrial Thermometer is off. No screws to bother with when removing the glass to clean it. Snap . . . it's on again . . . securely. The front can't fall as it is held firmly by a tongue and groove at the top.

Superior Structural Featurers

1. TAG-Hespo glass—easy to read.
2. Asbestos packing, uniformly compressed around enlargement on glass stem prevents movement of tube with reference to scale.
3. Left-handed thread on bulb chamber prevents loosening if case is turned in removing thermometer.
4. Thin Monel bulb chamber allows quick conductivity, yet is rugged and non-corrosive.
5. Connecting piece locked to case by specially designed split spring washer.
6. Mercury filling in bulb chamber completely surrounding bulb insures split-second transmission of heat.

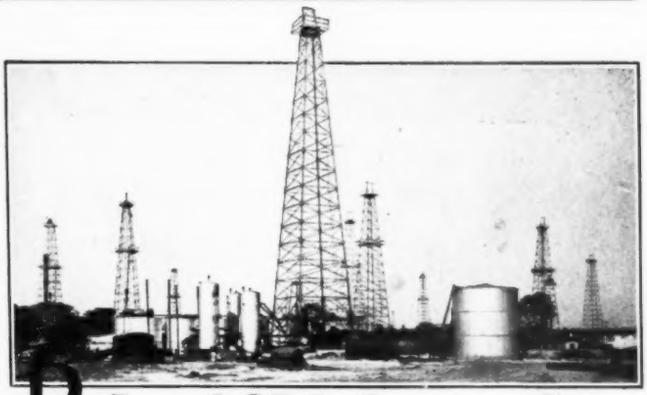
Bulletin No. 1033-51 — just off the press — describes and illustrates in detail the features of this NEW TAG Industrial Thermometer. Send for it!

C. J. TAGLIABUE MFG. CO.
PARK AND NOSTRAND AVES., BROOKLYN, N. Y.

Instruments for Indicating, Recording and Controlling

TAGLIABUE MFG. CO. BROOKLYN

BRANCH FACTORIES
CLEVELAND, OHIO — SAN FRANCISCO, CALIF. — SHREVEPORT, LA.



Pride of Oklahoma City

Washington Derricks were the pride of the deep drilling crews at Oklahoma City. Many of the Derricks were used before, being moved in from other fields as a result of preference born of confidence in their proven ability.

O'BRIEN STEEL CONSTRUCTION CO. INC.
WASHINGTON DERRICKS
RIG EQUIPMENT COMPANY

At no time in the history of drilling has there been a better demonstration of stamina and dependable construction such as exhibited by the large number of Washington Derricks used in this field.

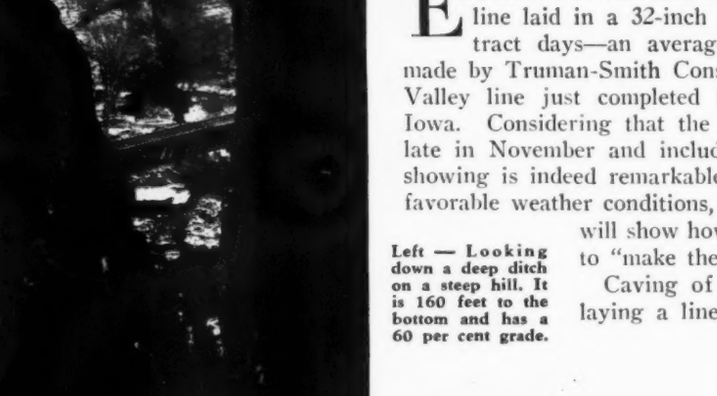
O'Brien Steel Construction Co., Inc.
Washington, Penna.
Western Representative:
RIG EQUIPMENT CO., 1224 N. W. 33rd St., Oklahoma City, Okla.

Initiative *of* Engineers

Left — Looking down a deep ditch on a steep hill. It is 160 feet to the bottom and has a 60 per cent grade.

EIGHTY-SEVEN and one-half miles of 20-inch, sleeve-coupled gas line laid in a 32-inch ditch of 74 inches average depth in 117 contract days—an average of over 3,800 feet per day—was the record made by Truman-Smith Construction Co. on their section of the Missouri Valley line just completed from the Texas Panhandle to Mason City, Iowa. Considering that the line laid through northern Iowa was started late in November and included five river crossings and two bridges, the showing is indeed remarkable. While such records are possible only with favorable weather conditions, mention of some of the problems encountered will show how initiative and proper use of equipment served to "make the breaks" in a number of instances.

Caving of the ditch is a problem to be expected when laying a line through reclaimed swamp land. Because of ditch caving, hand labor is both expensive and dangerous, especially in winter when large chunks of incrusted frost, broken by the weight of the machine, often slide into the trench, endangering the workmen. On the Missouri Valley line a crane with a half-yard clamshell was employed for cleaning out long sections of treacherous ditch.

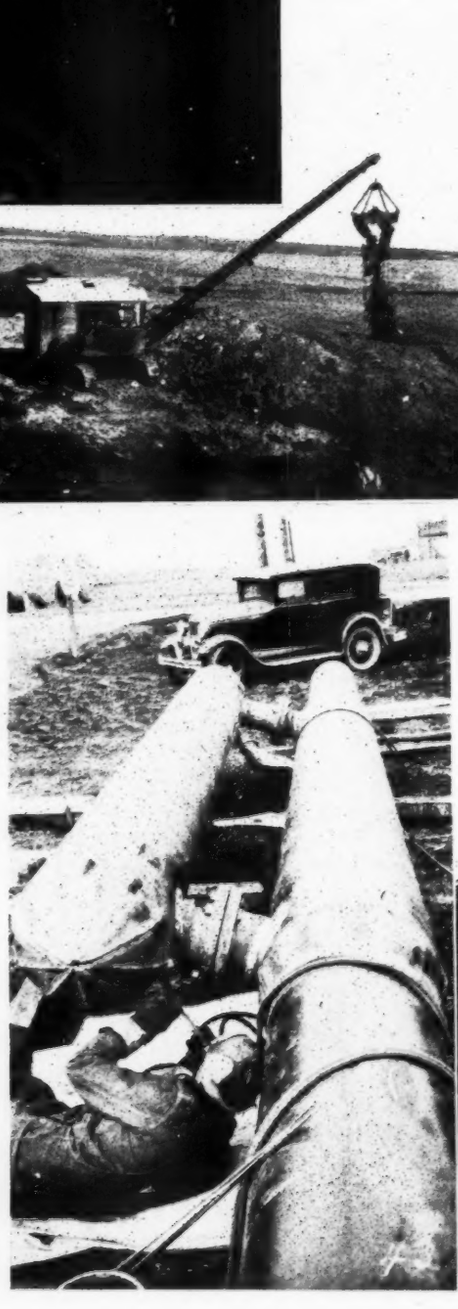


Above, right—Crane with a clamshell cleaning quicksand out of the trench at crossing of Iowa river.

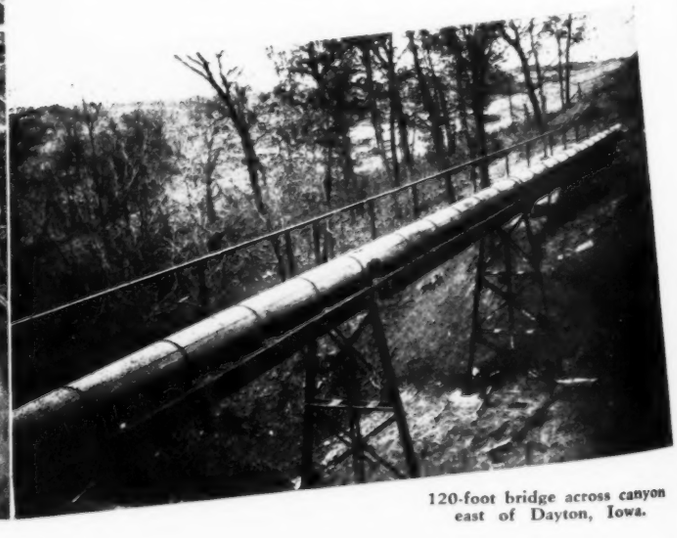
Where water-filled drainage tiles were cut, it was found advisable to allow the ditch to remain full of water, since its pressure against the sides prevented caving to a considerable extent. It was only when the laying crews approached that the pumps were brought into action.

The clamshell also proved valuable when digging holes for the six drips placed in the line. These drips, as usual, were installed at a point where the line started upward from a long sag.

A drip consists of two parts, the barrel and the header, the former being inserted into the straight run of the pipe line. The header is connected to the barrel by two 10-inch hydraulic nipples welded into the header near the ends. The barrel is made from a 20-foot length of 24-inch pipe, with a 20-inch by 24-inch swage welded on each end. The header is made of 20-inch pipe welded at the ends, and is set at a slight angle to the barrel so as to provide good drainage for moisture accumulation.



Welders tying in a header on a 20-inch drip.



120-foot bridge across canyon east of Dayton, Iowa.

Speeded Missouri Valley Line Work

By HOUSTON JOHNSON, *Pipe Line Engineer*

Into the drainage space of the header the end of a 3-inch bleeder line is inserted and led through the wall of the header up and outside the barrel to the surface.

Rivers crossed by the line included the Des Moines at Lehigh, Iowa, the Boone below Eagle Grove, and the Iowa twice above Belmonde. The Des Moines River, having a hard rock bottom and a strong, swift current, made a firm anchorage for the pipe necessary. Thick strata of slate and coal on the north bank rendered working from that side difficult. On the south was a low sandbar some 200 yards wide, through which the pipe was laid at considerable depth, joints having been welded, strapped, and a river clamp secured over each as protection against a possible change in the channel of the river.

A cofferdam was first attempted with the idea of extending it across the entire bed of the stream, four joints of pipe to be laid as ducts for the water. Made of sacks of sand wedged together and filled with wet sand that froze solid overnight, this dam proved impractical because of the swiftness of the current and the fact that ice clogged the pipes. The north end of the dam was then cut loose and swung around in a U shape, leaving an open channel for passage of the stream. With pumps working continuously to remove seepage, the stream bed was drilled and a trench some four feet deep blasted out. A three-joint, welded section of pipe was laid in the ditch and the welds strapped. After the pipe was thoroughly dried and cleaned it was given a thick cold-application of paint and the entire section wrapped in burlap. A heavy coat of the same paint was applied to the burlap and 7,600-pound river clamps set over each welded joint. A bull plug was placed on the stream end for protection against mud and water until the section could be tied in to the opposite shore line. The ditch was then filled with concrete. As soon as the concrete had set, the dam was torn away and rebuilt from the north side, where the process of blasting, cementing, etc., was repeated.

The Boone River presented no difficult problem other than that of blasting out two shelves of ice.

The small and innocent-looking Iowa, however, was a different proposition. In first crossing it the clamshell and pumps were worked overtime cleaning out quicksand that run in as fast as removed. The five-joint welded section was bent to conform to the ditch and snaked across, as the soft steep banks prevented its being transported on tractors. When crossing this river the second time a heavy blue clay bottom made a water-tight crossing easily possible. As in the case of the Des Moines River crossing, cofferdams with joints of pipe for ducts were resorted to. Quicksand was encountered in several of the open drainage ditches and, on one occasion, it was necessary to place half sections of river clamps on top of the pipe to anchor it.

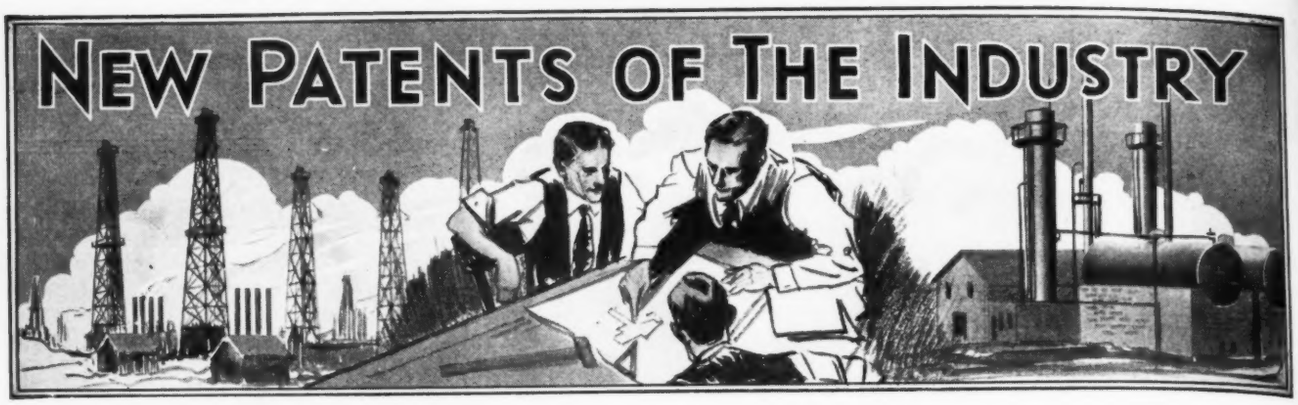
Two pipe line bridges were built near Dayton, Iowa. One carried a 240-foot span of six sleeve-coupled joints and the other a 120-foot span of three joints welded and strapped. Each span was tied with U bolts and fitted on the ends with extra long sleeve couplings to take care of expansion and contraction.

Right—Casing 200 feet of 20-inch pipe in 24-inch for a railroad crossing.

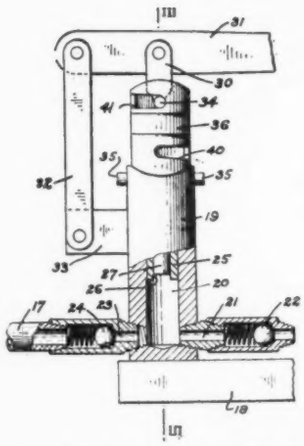
Clamshell and crane being used to clean out cavey ditch.

Crossing an open sewer ditch.

NEW PATENTS OF THE INDUSTRY

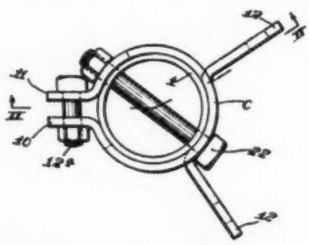


1,794,356. HYDRAULIC CORE EXTRACTOR. REUBEN C. BAKER, Coalinga, Calif., assignor to Baker Oil Tools, Inc., Huntington Park., Calif., a Corporation of California. Filed Jan. 21, 1930. Serial No. 422,351. 1 Claim. (Cl. 103—37.)

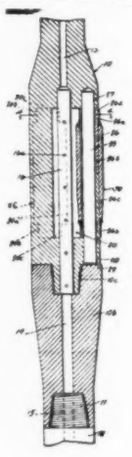


A device of the character described including a cylinder, a pair of reciprocable plungers concentrically mounted therein, a pair of lugs projecting from the outer surface of the cylinder at diametrically opposed points thereon, a pair of diametrically opposed lugs connected with the innermost plunger and arranged at right angles to the lugs on the cylinder, a catch member rotatably mounted on the outermost plunger, said catch member having depending portions, said depending portions having slots formed therein for engagement with the lugs on the cylinder to connect the outermost plunger to the cylinder, upwardly projecting portions on said catch member, said upwardly projecting portions having slots therein for engagement with the lugs on the innermost plunger, said slots in the upwardly projecting portions and downwardly projecting portions being so formed that rotation in one direction of the catch member will simultaneously release the catch member from one pair of lugs and engage the catch member with the other pair of lugs, and an operating lever connected with the innermost plunger for operating the device.

1,795,032. CLAMP FOR DERRICKS. JOHN D. MCEWEN, Pittsburgh, Pa., assignor to Lee C. Moore & Company, Incorporated, Pittsburgh, Pa., a Corporation of Pennsylvania. Filed Apr. 30, 1927. Serial No. 188,026. 3 Claims. (Cl. 189—19.)

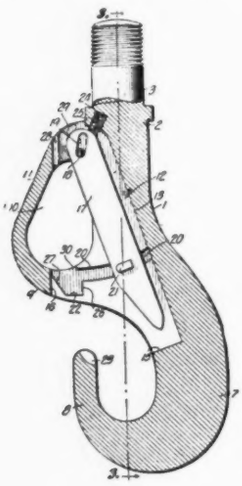


1. In the art of metal derricks for oil well drilling and the like, a clamp for connecting adjacent aligned sections of tubular derrick legs comprising a single metal plate bent to circular form with the meeting edges turned out to form substantially parallel flanges extending longitudinally the full length of the clamp, said flanges being perforated to receive compression bolts whereby to constrict the clamp to grip the ends of tubes inserted therein, and perforated ears struck up from the body of the plate and positioned for attachment to girts and braces of a derrick structure, the clamp having oppositely disposed perforations on each side of a median transverse plane positioned and adapted to receive transverse diametric bolts extending through the two walls of the clamp and through the ends of adjoining tube sections, whereby to attach the clamp to each of the adjoining tube sections and to rigidly connect them to each other, said ears being so positioned that a diametrical plane therebetween will not coincide with a diametrical plane between said flanges, whereby to provide maximum space for said through bolt holes in the body of the clamp.



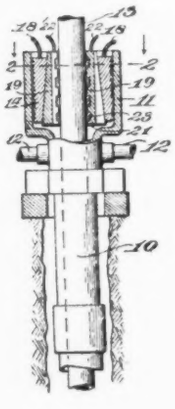
1,796,479. EXPANDING ROLLER UNDERREAMER. JAMES J. SANTIAGO, Los Angeles, Calif., assignor to John Grant, Los Angeles, Calif. Filed Oct. 19, 1927. Serial No. 227,107. 9 Claims. (Cl. 255—74.)

7. In a tool of the character described, a body, a mandrel pin mounted therein, a cutter carrier comprising an eccentric sleeve rotatably mounted on the mandrel pin, said eccentric sleeve being divided transversely into two parts and each part having at its outside end an eccentric head, a cutter mounted on the eccentric sleeve between the heads, and the body having a surface adapted to be engaged by the eccentric heads to limit their rotation and the rotation of the sleeve about the mandrel pin.



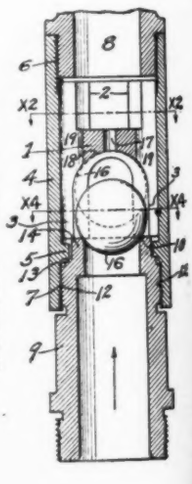
1,794,694. SAFETY HOOK. WILLIAM GUY JENSEN and KRESTEN RAY JENSEN, Coffeyville, Kans. Filed May 31, 1930. Serial No. 458,545. 11 Claims. (Cl. 24—241.)

1. In a safety hook, a body having a recess in its front face, a pivot pin in said recess, a latching bar slidably and pivotally mounted on the pin, and adapted to engage the bill of the body on its inner face, and means for retaining the bar in bill-engaging position.



1,794,662. CASINGHEAD PACKER. ELIJAH J. ZERR, Glendale, Calif. Filed Oct. 9, 1928. Serial No. 311,269. 7 Claims. (Cl. 286—16.)

1. In a casinghead packer, a bowl secured to the upper end of the casing, a ring removably positioned within said bowl, the wall of which ring tapers in thickness toward its lower end, a sectional member arranged within said ring, the wall of which sectional member gradually tapers in thickness toward its upper end and sectional packing rings seated in the inner face of said member.

1,796,455. BALL-VALVE ASSEMBLY. ROBERT W. GUNN and WILLSIE A. SCOTT THOMPSON, Los Angeles, Calif., assignors, by mesne assignments, to Emsco Derrick & Equipment Company, Los Angeles, Calif., a Corporation of California. Filed Dec. 27, 1927. Serial No. 242,624. 4 Claims. (Cl. 137—69.)

3. As a new article of manufacture, a guide and bumper for ball valves comprising a bridge having a centrally disposed bore extending therethrough, and a seat on its lower surface surrounding said bore, and legs extending from said bridge in opposite directions and having arcuated outer faces and concave inner faces.